SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

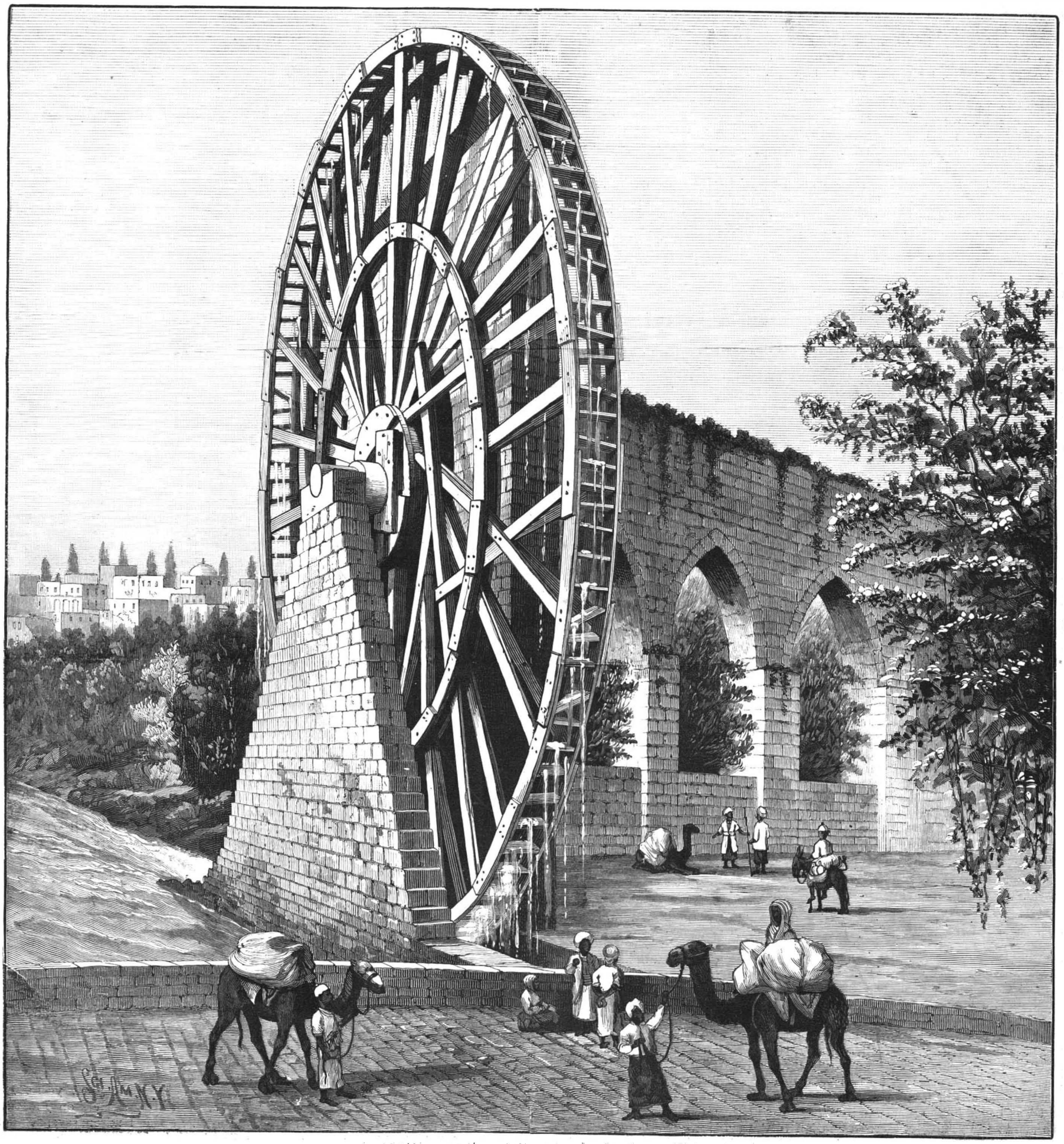
Vol. LVI.—No. 5. [NEW SERIES.] NEW YORK, JANUARY 29, 1887. [Price 10 Cents. $3.00 per Year.

THE WATER WHEELS OF HAMATH.

Through the plain of Hamath, in Syria, following a general northerly direction, runs the river Nahr el Aasy, or Orontes. It is fed by the waters of Lebanon. Near the end of its course it bends to the westward, and passing through the Valley of Antioch, discharges into the Mediterranean nearly opposite the island of Cyprus. It is the main reliance of the great plain for its water supply. Hundreds of water wheels, some turned by the current, others caused to revolve by animal power, are situated upon its banks. The region depends upon these for its agricultural prosperity.

Where water is to be raised from wells of some depth, an endless rope carrying buckets is caused to descend on one side and ascend upon the other into and out of the well. The rising portion carries up the buckets filled. As they reach a certain point they are emptied into an aqueduct and descend again empty. The rope is often made out of branches of the myrtle, as that is so rough that it does not slip. A camel walking round and round in a circle turns a vertical spindle, which by rude gearing works the endless rope of the buckets. Considerable quantities of water can be thus raised. But the characteristic wheel of the "land of Hamath" is different from this. The river itself is the great source of power, and water wheels turned by the current are largely used. At the principal cities of Horus and Hamath many are employed to supply the personal needs of the inhabitants, and these cities are quite famous for their wheels. The whole region is of great interest in its relation to the books of the Old Testament. Many allusions to the land of and to the "entrance into Hamath" occur there.

The wheels vary not only in character, but in size. Some, such as that just described, are adapted to be turned by a single draught animal, while others are of vast dimensions, sometimes over eighty feet in diameter. They are an important advance upon the Egyptian "shadoof." The latter is a version of the old-fashioned



THE GREAT WATER WHEEL AT HAMATH, TURKEY.

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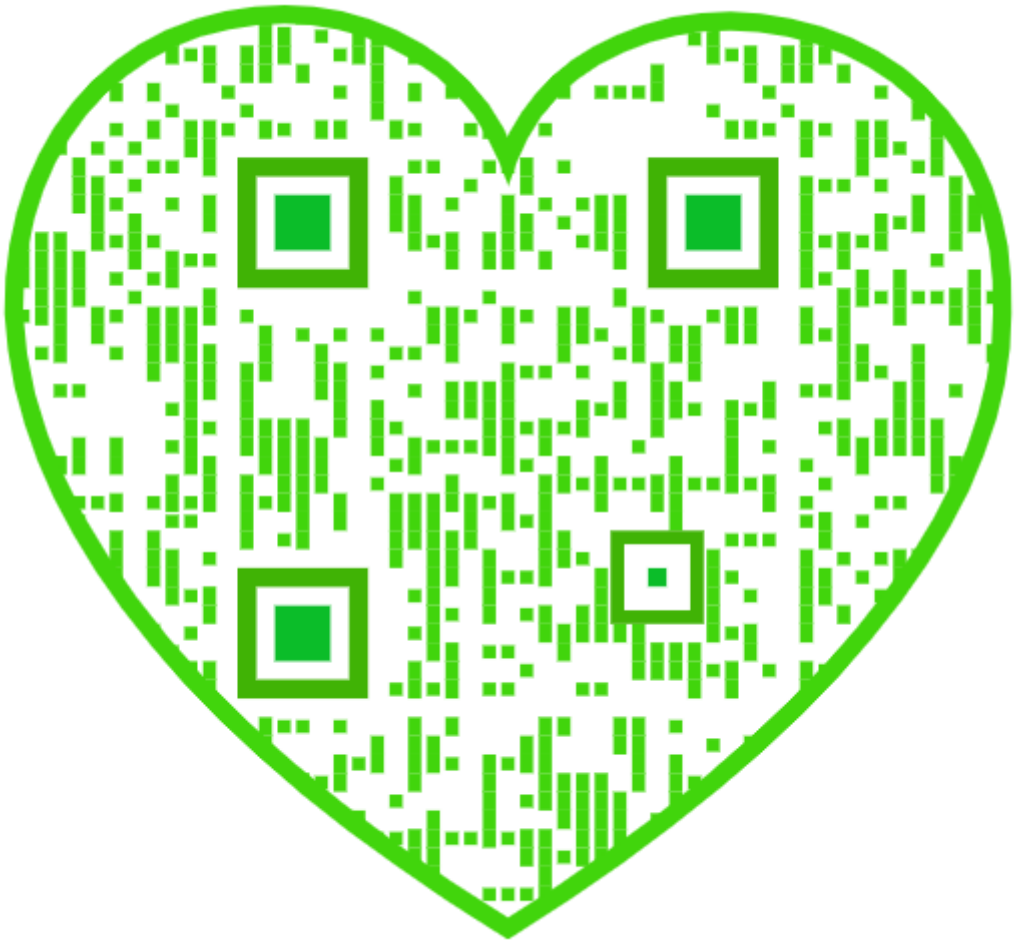

well sweep so common in this country. A pole works upon a fulcrum, is weighted at one end, and carries a rope or pole and bucket at the other. A workman draws down the bucket and fills it, and allows the heavy counterpoise to carry it up. He then empties it into a reservoir or canal. If one man cannot raise it high enough, it is dipped out of the canal by another shadoof, and carried to a higher point. In some cases a regularly terraced arrangement of shadoofs is seen.

These, of course, are intermittent in supply. But where the endless rope or revolving wheel is used, a fair approach to continuous operation is attained. The wheel is called *na'urah* in Arabic. We illustrate in the engraving one of the largest, from a photograph of the city of Hamath.

The city, the ancient Epiphania or Hamath, lies about 120 miles north of Damascus, and on both sides of the river Orontes. The city is supplied with water by about six of these wheels, which deliver water into elevated conduits. Each wheel and conduit is owned by a separate company. They are undershot water wheels. The river is partially dammed, a combined causeway and dam securing the necessary difference of elevation or head of water for the running of the wheels. A portion of this causeway appears in the foreground of the view. A chute or flume is thus formed, and the great wheel towers up from the flume and ceaselessly rotates.

Around its periphery is a series of buckets. As these descend on one side into the water they become filled. The wheel turning carries them up full on the other side until a point near the top is reached. There they are discharged into an elevated aqueduct through which the water flows into the city.

The city has a population of thirty or forty thousand souls. Of these, three-quarters are Moslems, and most of the rest Greeks or fellahs. This great population depends upon these wheels for its water supply. They are, despite their great size, of quite primitive workmanship and of low efficiency. They are constructed entirely of wood. Much of their expense is involved in the cost of repairs. This item is necessarily large.

The whole region is far from modern civilization. There are no railroads for the transportation of heavy material, and there is no supply of fuel. Hence steam pumps are not available. The population of the country parts are largely devoted to agriculture, and could use any quantity of water. It would seem that in this great plain a field for enterprise might be found for some of our hydraulic engineers.

In Egypt, the introduction of improved machinery for raising water has had the most beneficial results. In the plain of Hamath, with its cities of Horus—the ancient Emesa—and Hamath is another region adapted for such work.

The city of Hamath is now insufficiently supplied, both as regards quantity and head of water. From a letter recently received from Mr. John Baetzner, who had recently visited the city, we hear that the authorities and citizens alike are complaining of the deficient supply. When a place so completely Oriental as this makes such a complaint, it indicates an unmistakable want. By the dams a head of about eight feet of water in the river at the city is secured. There would appear to be but little trouble in causing this to work improved water wheels, turbines or undershot, which might be made to drive pumps; or some system of hydraulic rams might be available.

Our correspondent believes that such improvements could be advantageously introduced. While Turkey and its dependencies are very poor, it is under such conditions that economy is imperatively necessary. Improved machinery always effects an ultimate saving, though its first cost may seem great.

Our view of the wheel is taken from a photograph sent to us by Mr. Baetzner. The picture, taken in the clear Syrian air, is a marvel of photographic perfection. By a magnifying glass the smallest details of distant objects can be discerned.

Hints to Employes.

There is only one spirit that achieves a great success. The man who seeks only how to make himself most useful, who aim is to render himself indispensable to his employer, whose whole being is animated with the purpose to fill the largest possible place in the walk assigned to him, has in the exhibition of that spirit the guarantee of success. He commands the situation, and shall walk in the light of prosperity all his days. On the other hand, the man who accepts the unwholesome advice of the demagogue and seeks only how little he may do, and how easy he may render his place and not lose his employment altogether, is unfit for service. As soon as there is a supernumerary on the list, he becomes disengaged as least valuable to his employer. The man who is afraid of doing too much is near of kin to him who seeks to do nothing, and was begot in the same family. They are neither of them in the remotest degree a relation to the man whose willingness to do everything possible to his touch places him at the head of the active list.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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NEW YORK, SATURDAY, JANUARY 29, 1887.

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DEFEAT OF THE OBNOXIOUS PATENT BILL.

We have much pleasure in announcing the defeat in the House of Representatives, on the 17th inst., of bill H. R. 4,458. In our paper of January 8 we gave the full text of the bill. Its fundamental idea was the emasculation from the patent laws of the right of inventors to collect damages for infringement, thus practically giving to infringers free liberty to make use of and sell any patented invention they might desire. The passage of the bill would have injured almost every industrial establishment in the country.

The bill was defeated by the very decisive vote of 156 nays to 81 yeas; not voting, 82. The thanks of the nation are due to the 156 representatives who knew their duty, and when the vote came did not hesitate to do it.

In December last, when the bill came up in the House, Mr. Townshend, of Illinois, the father and most able advocate of the bill, and a member of the Patent Committee, stated that the Committee unanimously asked that the rules might be suspended and the bill passed. Only thirty minutes were allowed for debate; and when the allotted time had passed, an adjournment took place, which carried the vote on the bill over until the present time.

It now appears that of the thirteen members of the committee only five were in favor of the bill, four were against it, and four did not venture to vote.

Several other unsatisfactory amendment bills are still pending. We trust they will be carefully scrutinized and defeated.

TWO USEFUL LIVES.

The close of the year 1886 has witnessed the death of two Frenchmen whose names are intimately connected with the later history of grape culture, especially in relation to the grapevine phylloxera.

On the 25th of November, 1886, Louis Bazille died at his home in Montpellier. Born October 23, 1828, he inherited from his father a strong taste for agriculture as well as commercial affairs. Modest, retiring, beloved by every one who knew him, he has left an honored name, but will be chiefly remembered for the deep interest he took in all matters relating to phylloxera, his own grounds at St. Auns having become, from 1872, an experimental station for American vines. In 1876, he translated into French Bush & Son & Meissner's Catalogue of American Grapevines.

Five days later, on the 30th of November, 1886, Jules Lichtenstein departed this life. To entomologists he was well known the world over for his original researches in the life habits of plant lice (Aphididæ). Grandson of the naturalist George Lichtenstein and nephew of the scientist Henri Lichtenstein, who was inspector of Museums of Natural History in Prussia, Jules had a great fondness for natural science from a boy, and always possessed a passion for the study of insect habits. In 1868, just at the time when the then new plague of the grapevine in France was being discussed and attributed to one cause or another, it was Lichtenstein, who suggested that the insect which was found to be the cause of the trouble was the same as that described by Asa Fitch under the name of *Pemphigus vitifoliæ* in the United States. It was on the 10th of August that this suggestion was first made by Lichtenstein and subsequently, in 1869, he reiterated the opinion with more confidence after having received Professor C. V. Riley's illustrated article on this insect in the *American Entomologist* for August, 1869 (Vol. I., p. 248). This hypothesis was confirmed by correspondence with Riley, and more particularly by the latter's visit to France in 1871, when he had occasion to carefully study phylloxera in France; and, upon his return to America, found it affecting our vines upon the roots also. Learning from Riley's writings of the immunity of some of our vines from phylloxera in this country, thus confirming the prior observations of Laliman at Bordeaux, Lichtenstein may be said to have been contemporaneous with Riley in urging the use of these resistant vines as stocks on which to graft the more susceptible European varieties—a recommendation which has been fraught with such vast benefit to the phylloxera-infested portions of Europe and of California, and which has reacted so beneficially to grape growers in this country. Lichtenstein was a man of fine figure, whole souled and amiable almost to a fault. All those who came in contact with him bear evidence to his enthusiasm and his lovable nature. He had also a poetic temperament, which sometimes led him astray in matters of exact science, but it may confidently be said that there are few Frenchmen who have done more toward advancing our knowledge of the difficulties which the grape grower has to contend with, both in Europe and here.

Dr. William Perry.

Dr. William Perry, the oldest person in Exeter, N. H., and the oldest graduate of Harvard College, died there, January 11, aged ninety-eight years. He was the sole survivor of the passengers on Fulton's first steamboat ride down the Hudson, seventy-nine years ago. He was born in Norton, Mass., in 1788, and was a member of the class of 1811 in Harvard.

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Prof. Edward Livingstone Youmans.

On Tuesday, January 11, this well-known scientific writer and lecturer died, at his home in this city, of catarrhal fibroid consumption. Two years ago he suffered from an attack of pneumonia that permanently affected his lungs. His life is an interesting and typical one. For about forty years he was closely connected with the house of D. Appleton & Co., as their scientific adviser. Their list of scientific works may be regarded as largely the outcome of Prof. Youmans' counsel. He was born at Coeymans, N. Y., on the 3d of June, 1821. At the age of 13 he had ophthalmia, which for a while left him totally blind. His eyes were never again perfect, and he often lost the use of them. Notwithstanding this obstacle, he studied and experimented in physics and chemistry, enjoying the assistance of his sister, Anne Eliza Youmans, herself a well-known scientific writer. He invented a writing machine to render him as little dependent as possible upon his eyes, and with it began his work as a writer. From the University of Vermont he received the degree of M.D., but he never practiced medicine. He filled the chair of chemistry in Antioch College, Yellow Springs, Ohio. This institution under the auspicies of the Unitarian Church was founded in 1852. His duties here commenced in 1866, and after that he was always known as Professor Youmans.

Led by his sister, the almost blind scientist is said to have called upon the Appletons over forty years ago, to make arrangements for the purchase of books for his own use. This visit brought about his connection with the firm, and in 1852 his "Class Book of Chemistry" was published by them. This had a great success, and in 1860 was translated into Spanish. He rewrote the work in 1875, a period when the new system of chemical equivalents and symbols was firmly established. His list of works also include the following: "Alcohol and the Constitution of Man," 1853; "The Chemical Atlas," with text, 1855; "The Handbook of Household Science," 1857; "The Correlation and Conservation of Forces," 1864; and "The Culture Demanded by Modern Life," 1867.

He was a succes ful popular lecturer, evincing a strong leaning toward the doctrines of Darwin and Spencer. He arranged with Prof. Tyndall for the latter's lecture course in this country. He himself was most cordially received in London by the scientific circle, including Huxley, Tyndall, and others. In 1871 he took up the international copyright system and organized ultimately, after several visits to England, the "International Science Series." The works in this collection are published in London, New York, Paris, Leipsic, Milan, and St. Petersburg. Fifty-seven works have been issued already. In 1872 the *Popular Science Monthly* was founded by him. He has ever since that period been editor in conjunction with his brother, Dr. W. J. Youmans, who has assisted in the work.

He leaves a wife, but no children. His father nd mother, both extremely advanced in age, still survive him.

He was noted as one of the early advocates of the doctrines of the "Conservation of Force" (or "of Energy," under its modern acceptation) and of the "Correlation of Forces." The bent of his mind may be clearly discerned in the columns of the *Popular Science Monthly*.

For upward of six months he had been practically absent from his office, and for many years had done much of his work at home. His record as a worker under his natural obstacles is a most creditable one.

Drilling Holes in Plate Glass.

The last volume of the "Transactions of the American Society of Mechanical Engineers," recently issued, contains a discussion on the best method of drilling holes in plate glass, which contains some points of interest to our readers.

Mr. Durfee mentioned his successful experience in drilling holes three-sixteenths of an inch in diameter through glass plates about one-eighth of an inch thick, by the use of an ordinary bow drill, with spirits of turpentine as lubricant. The holes were drilled from one side until the drill just punctured the opposite side of the glass; then the glass was turned over and the holes finished by drilling from the opposite side.

Mr. Oberlin Smith recorded fair success with a very hard drill and the same lubricant in drilling holes one-half inch in diameter in plates one-quarter of an inch thick; but instead of turning over the glass, he put a piece of perfectly flat cast iron under the glass, with a little piece of paper between, clamping all firmly together, and permitted the drill to puncture the iron a little.

Mr. Ashworth referred to the remarkable efficacy of the sand blast steam jet in drilling holes through glass, and Mr. Towne stated that that was, undoubtedly, the best method where the work is to be done in large quantities and can be sent out to be done. But for doing the work in small quantities in one's own establishment, he instanced the method employed in the works of the Yale & Towne Manufacturing Company for drilling holes seven-sixteenths of an inch in diameter through glass one-eighth of an inch thick. The best tool for the work was found to be a brass tube five one-hundredths of an inch thick, the cutting agent being emery, No. 5 H, and the lubricant simply water, which they had found as efficient as oil or turpentine, and much less troublesome.

Thus the workman was able to drill thirty to forty holes per hour, the drill being run at 2,000 revolutions per minute, and the drilling of forty holes through the one-eighth inch glass using up about one inch of the tube. Mr. Towne added that it was important to keep the emery well washed and cleaned, that is, with the dust removed from it which results from the abrasion of the glass.

For small holes, Mr. Stetson could conceive of nothing better than the diamond drill.

The Arthur Kill Bridge.

The plans of the Baltimore and Ohio Railroad for a bridge over the river or Arthur Kill, near New York, are not approved by the War Department engineers. This kill is one of the waterways between New York Bay and Raritan Bay.

The Secretary of War has lately transmitted to the Senate, in response to a resolution of that body, a report of the Board of Engineers for Fortifications and River and Harbor Improvements on the proposed bridge across the Arthur Kill, Staten Island Sound. The report is accompanied by voluminous documents, giving in detail the data on which the report is based. It says that the amount of freight which annually passes the site of the proposed bridge across the Arthur Kill will approach 5,750,000 or 6,000,000 tons of actual freight, an amount in excess of the tonnage of foreign commerce cleared from New York for 1885. It is thus seen, says the report, that so far as tonnage is concerned, this is one of the great waterways of this country, and indeed of the world. Of this vast amount of freight, probably nine-tenths is in tows, sometimes reaching 70 vessels to one tow. The tows are usually made up of five vessels abreast, and are eight vessels long, and their dimensions are 100 to 125 feet in width by about 800 feet long. Under the plan submitted by the Staten Island Rapid Transit Company, such masses of vessels are to pass through a clear opening between piers about 200 feet wide.

The report says that the experience at the draw at the mouth of the Raritan River, through which only about one-third as much freight passes as through the Arthur Kill, and which has 207 feet draw openings, shows that the draw at that place is a serious obstruction to navigation, and has caused considerable losses from delay and collisions. The tows to go north through the Arthur Kill pass the proposed site of the bridge while the tide is running flood, and when any collision would produce great damage. They are much larger than those passing through the Raritan draw, and it is impracticable for these large tows to anchor, as the smaller ones do at the Raritan draw. The board is, therefore, of the opinion that if a bridge were constructed as proposed, with a pier in the middle of the Kill, it would make necessary a large reduction in the size of the tows and the consequent increase in the cost of transportation; and it is of opinion that if there were a natural obstruction so serious as a pier in the middle of the stream, its removal would be urgently and rightfully demanded, even at great cost. The obstruction is not there now, and should not be placed there to the injury of navigation in order to save a few hundred thousand dollars to the railroad company.

The proposed bridge, the report says, is also of insufficient height, the lowest part of the superstructure being only 34 feet 8 inches above mean low water. For these reasons the board recommends to the Secretary of War a bridge at the site proposed, the channel face of whose east pier shall be on the Staten Island bulkhead or shore line, and whose channel span shall give a clear opening of 450 feet; whose span next west shall be a draw span, giving 125 feet clear opening, the lowest parts of these spans being 50 feet above mean high water. The foundations of the pier should be so arranged as to admit future deepening of the kill to 20 feet.

"Such a bridge will be an obstruction and an inconvenience," the report says, "but will not in any serious degree increase the cost of transportation. It involves some increase of cost to the railroad company, but no more than it should bear rather than infringe on the pre-existing rights of navigation."

The Sealing of Letters.

How were letters sealed before the invention of gummed envelopes? In one of the last numbers of *Le Livre*, Mr. S. Blondel has an interesting article upon this subject, in which he describes all the methods of sealing that have been successively employed from the remotest antiquity. The first seals consisted of a ring that was affixed to clay or bole, and later to chalk or *creta astatica*, a mixture of pitch, wax, and plaster. The use of wax did not begin to become general till the Middle Ages. Beeswax, rendered yellow by time, was the first material used. Then came sealing wax mixed with a white substance. Red wax began with Louis VI., in 1113; and green wax made its appearance about the year 1163.

In the thirteenth century, yellow, brown, rose, black, and blue were added to the foregoing colors. Black wax is a rarity met with in the seals of the military religious orders.

Among the ancients, ring seals were used not only for sealing letters, but also, as small locks were not common, for sealing caskets and chests that contained valuable objects; and they were even employed for sealing the doors of houses and apartments.

Under the First Empire, people began to use wafers, which were brought from Italy by the soldiers and officers of the French army. These wafers were cut with a punch out of a thin leaf made of flour. Finally, gummed envelopes gradually began to replace sealing wax and wafers nearly everywhere. The first envelopes, which were manufactured in England, date back to 1840. The machine for folding them was invented in 1843, by Messrs. Edwin Hill and Warren de la Rue, and in 1849 was so improved by the latter that it was capable of folding and gumming 3,600 envelopes per hour. Since 1850, the annual production of envelopes has been greatly increasing, and there are now being daily manufactured in Paris alone 1,500,000.

As regards the seals used by certain famous individuals when the use of wax was in vogue, *Le Livre* gives the following information:

Goethe, after his return from Italy, almost always se his letters with an antique head, such as that of Socrates, Minerva, or Leda. The astronomer Lalande's seal had a ship engraved upon it, and Meyerbeer's had a lyre, with the legend "Always in tune." Victor Hugo had a very simple seal. At the sale of his effects in 1 Arsene Houssaye bought a seal with the initials V. H. so arranged that when inverted they formed the cipher A. H.—*La Science en Famille.*

Drain Pipe Traps.

In the convention of the American Institute of Architects, held in New York city, Dec. 1, 2, and 3, a report was presented by Mr. Glenn Brown, architect, Washington, D. C., on the subject of experiments in "Trap Siphonage."

The investigations relating to this subject were carried out at the Museum of Hygiene of the Navy Department, at Washington, D. C.

The experiments have been conducted with the view of obtaining simply facts, without the ulterior object of introducing some patented article, where commercial interests are concerned. There were tests made of existing systems of trap ventilation, and patented traps that claim to need no ventilation. In testing the different forms and manufactures, the fixtures were subjected to a strain equal to what they would receive in actual use, and also strains more severe than ordinary uses, and intended to cover unusual demands. To quote from the report: "The majority of the experiments have been made to test the power of the traps to resist siphonage and back pressure produced by the column of water passing down the vertical pipes. The question of first importance is: *Does ventilation protect the seal of traps in ordinary use?*" Ninety-nine tests of vent pipes and traps are recorded in the report, "in all of which the vent pipes were open and a positive effort was made to break the seal of the traps," except in "the first experiment, when the fresh air inlet at the foot of the soil pipe, and the opening at the roof, were closed, in this way subjecting the traps to the greatest strain which they could possibly have to resist, for either siphonage or back pressure." The deductions arrived at, according to tests, are as follows:

1. The seals of ventilated traps are safe against siphonage and back pressure.
2. The seals of unventilated traps are never safe from siphon action or back pressure, except in deduction four.
3. The vertical vent should be three inches, with a four inch soil pipe.
4. Traps connected on a horizontal pipe and fixtures discharging on the same level into horizontal pipe apparently have no effect on unventilated traps.
5. All varieties of non-mechanical traps are more easily affected by back pressure than by siphonage.
6. The ball traps were not affected by back pressure, but by siphonage.
7. The Sanitas trap withstood siphon action better than any of the patent traps, but was easily affected by back pressure.
8. The sewer air is more liable to enter unawares by back pressure through the seal of the trap, because the seal remains unbroken.
9. Difference in friction of iron and lead pipes made no apparent difference in the effect on the traps.

An Early Subscriber.

In a note accompanying his subscription for 1887, Mr. J. E. Emerson, of Beaver Falls, Pa., claims to be the oldest subscriber to the SCIENTIFIC AMERICAN. His name has been constantly on our subscription list for forty years. No one can claim to have a file of the papers from a much earlier date.

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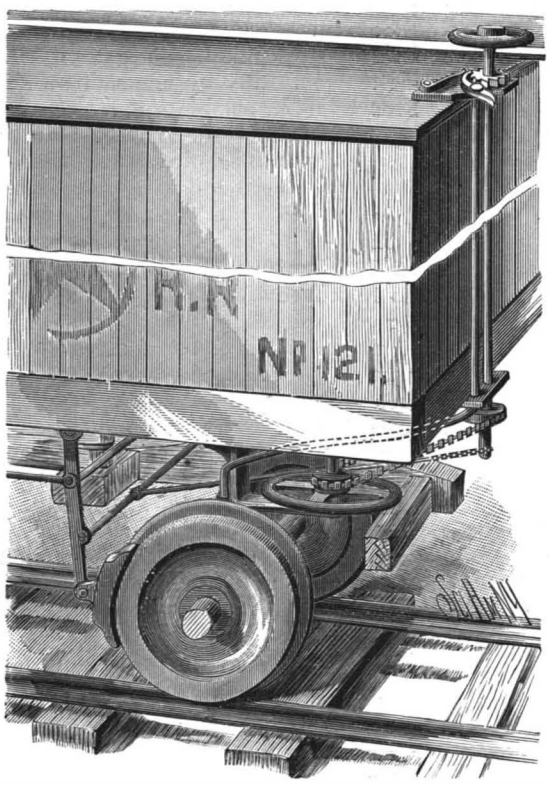
CAR BRAKE ATTACHMENT.

In this attachment the body of the car is, as usual, provided with a brake shaft having an upper hand wheel. The lower end of the shaft is connected to the brake lever by a rod and chain. Upon the shaft is placed a sprocket wheel, with which engages a chain passing around a second wheel carried by a shaft mounted in a bracket secured to the bottom of the car. This second shaft carries a large hand wheel, by turning which the brake shaft may be turned and the brakes applied. The top of the brake shaft carries the usual ratchet wheel, engaged by a pawl forced into engagement with the wheel by a spring. The pawl is carried by a vertical rod, to the lower end of which is secured an outwardly extending lever arm, the arrangement being such that by throwing the lever forward (toward the right in the engraving), the pawl will be moved from engagement with the ratchet wheel, thus releasing the brake shaft and throwing off the brakes. In one modification of this construction the lower hand wheel is dispensed with, its place being supplied by a ratchet lever, the reciprocating movement of which imparts a rotary motion to the short shaft carrying a sprocket wheel of the chain. In another modification the sprocket wheels and chain are replaced by a train of gearing. It is evident that, by means of this attachment, the brakes may be applied or released from either the roof of the car or from the ground.



QUATERMASS' CAR BRAKE ATTACHMENT.

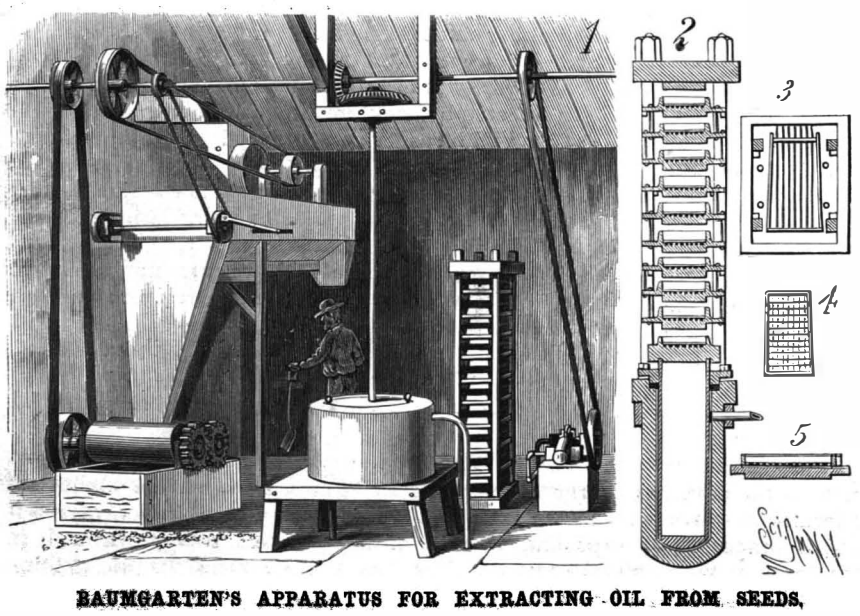
This invention has been patented by Mr. Reuben Quatermass, of Moline, Kansas.

APPARATUS FOR EXTRACTING OIL FROM SEEDS.

The apparatus here illustrated is designed for extracting the oil from cotton and other oil-bearing seeds. The seeds are led from a gin, by a conveyer, into the hopper of a huller, where the hulls are separated from the kernels, the former being allowed to escape through a chute to the outside of the building, while the latter pass by another chute directly into a crusher. The huller is provided with two metal burrs having slots in their faces to receive sharp knives; one of the burrs remains stationary while the other rotates. A sheet iron casing inclosing the burrs is provided with a spout, which conveys the hulled seed into a screen box or separator which has two sieves, rigidly connected together, and suspended within the box in such a manner as to receive a reciprocating motion. The sieves have opposite inclinations, the upper one discharging the kernels upon the lower one, from which they pass into a conveyer in the bottom of the separator, which leads them to the crusher. The next stage in the process is performed by the crusher, which is simply a strong iron frame carrying two geared and adjustable chilled rollers. From the crusher the kernels are conveyed to a heater, in which they are reduced to what may be termed "a condition of cooked meal." This meal is then wrapped in cloth in properly shaped packages to enter the hydraulic press, which is shown in vertical section in Fig. 2.

Water is supplied to the cylinder, within which is a hollow ram, through a pipe leading from a suitable pump. Extending upward from the top of the cylinder are guide rods, shown in the cross sectional view, Fig. 3, up and down which the pressing plates move. These plates, which are shown in section in Fig. 5, and the lower one of which is attached to the plunger, are built up in sets of two or more, the several plates in each set being loosely connected by bolts with each other, so that the lower plates of each set are suspended from the upper ones and are free to move upward, when pressure is applied, independently of each other, but are kept at their proper distances apart for charging with the meal when the ram is down. Each plate is cast in a single piece, then planed smooth, and grooved to allow the oil to escape. The upper faces of the plates are constructed with raised ribs at the inner ends and for a portion of the sides of the grooves; within the space thus formed is placed a screen, Fig. 4, of closely woven wire cloth, which allows the free passage of the oil to the grooves without exposing them to being choked by the material being compressed. From the above brief description it will be seen that this apparatus is very simple and compact, and that it is well adapted to the work required.

These inventions have been patented by Mr. Christian Baumgarten, of Schulenburg, Texas.



BAUMGARTEN'S APPARATUS FOR EXTRACTING OIL FROM SEEDS.

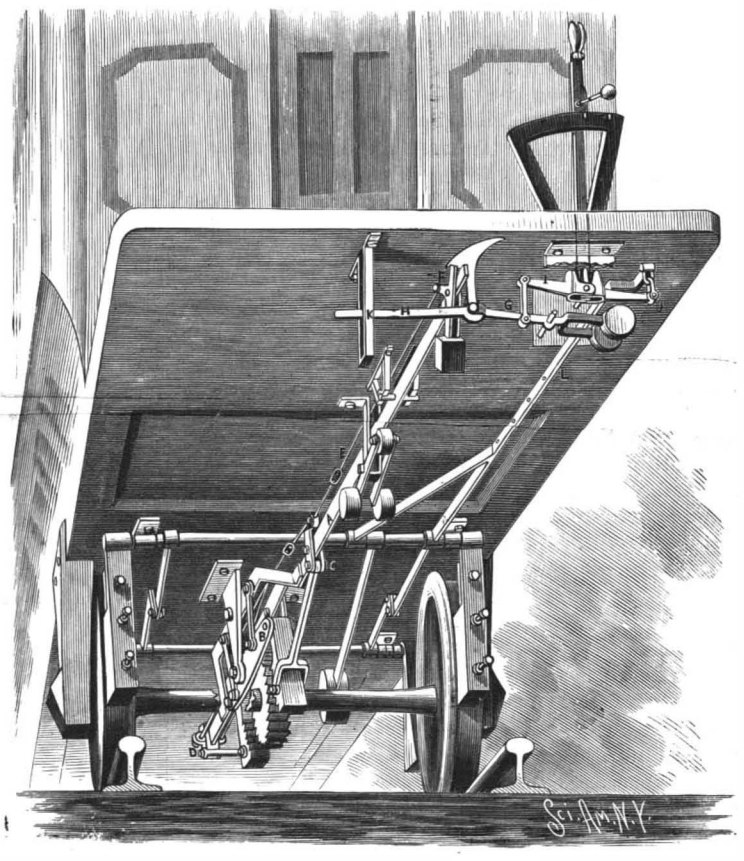
Causes of Boiler Explosions.

The *Ingenieur-Conseil*, of Brussels, has recently published a paper by Mr. Hochereau, formerly an artillery officer and director of the Haine-St. Pierre Works, upon the causes of the fulminating explosions of steam boilers, which are nearly always accompanied with, or preceded by, one or more violent detonations. Mr. Hochereau thinks that such explosions should be attributed principally, if not exclusively, to the inflammation, through an electric spark, of a mixture of air and pure or more or less carbureted hydrogen gas produced in the boilers. After citing numerous facts and calculating the expansive power of a mixture of air and pure or carbureted hydrogen, he concludes as follows:

1. In boilers that have exploded, there exists a mixture of air and more or less carbureted hydrogen. 2. Boilers fed with water containing organic matter, especially fatty substances, have been most frequently the ones subject to explosion. 3. Organic substances—animal or vegetable—are sources of an abundance of hydrogen, which is derived from their decomposition, probably when, contained in an insoluble soap, they are highly heated. A sloping deposit may be a proof of the presence of such substances; it may be formed in the water at any depth; and it does not indicate that the water has lowered to that point. 4. The electric spark which is produced through the friction of globular steam in narrow passages is the firebrand that lights these mixtures of expansive gasses. The result is that the dangerous moment is that in which the engine is started. Engineer Parkes has observed that out of 24 marine boilers, 19 exploded at the moment of starting up, and 4 when the piston had reached the end of its stroke. But the explosion may occur when the engine is not running, since the gas, having filled a space, such as that in the dome, may, by flowing into the upper part of the boiler, reach an imperfect joint where an electric spark is produced. 5. The live, expansive power of these inflamed gases is very great, and depends upon the proportions of the mixture. The accident may likewise occur without detonation. Thus, the inflamed gas, making its way between the valve chests and between the domes, is mixed with steam in such a proportion that it does not detonate, but acts like a burning quickmatch. 6. The lowering of the manometric pressure before the explosion is a consequence of the presence of the gas, and denotes danger.—*Chronique Industrielle.*

CAR STARTER AND BRAKE.

The main objects of this invention, which has been patented by Messrs. Thomas Cox and Thomas Cox, Jr., of Gloster, Montana, are to entirely dispense with the use of springs, and to so arrange the parts that the starting mechanism may be employed from time to time in quick succession, should the load upon the car be excessively heavy. Upon the axle is keyed a toothed wheel, and just above the axle is secured a downwardly extending bracket, which serves as a pivotal support for the main operating lever, A, and for a beam lever, B. These levers are connected by links arranged as closely as possible upon either side of the fulcrum of the beam lever, to each end of which is pivoted a clutch. One clutch is connected by a link with the rocker, C, carried by the lever, A, while the other clutch is connected with a sliding block, D, mounted upon the rear end of the lever, A. A connecting rod, E, extends from the upper end of the rocker, C, forward to a bell crank lever, F, pivotally attached to the forward end of the lever, A, the rod being connected to the vertical arm, the other arm extending forward in a plane just above that occupied by the forward end of the lever, A, and being provided with a weight.



COX'S CAR STARTER AND BRAKE.

These parts project outward through a vertical guideway formed by a bracket secured to the platform, the points of the two levers being in the path of a latch piece pivoted to the end of a lever, G, pivoted in a frame. The latch is formed with a heavy arm, H, which is guided in a vertical way formed in a bracket, K. The upper face of the latch is curved, and upon its lower end is a stop which bears against the under edge of the lever, G, which carries a weight. A shaft mounted in a frame carries two arms, I J, the ends of which are forked and formed with holes, through which the shaft passes. The forked ends of the levers are formed with shoulders, against which a lever mounted upon the same shaft may be brought to bear. The ends of the levers, I and G, are connected by a link. The normal position of the parts is shown in the engraving. When the operating lever is thrown to the left, the lever, I, will move to carry down the unweighted end of the lever, G. This motion will rock the bell crank lever, and thereby advance the rod, E, when the clutches will be thrown into engagement with the toothed wheel. As the motion of the main lever is continued, the rod, A, will be carried downward to rock the beam, B, and start the wheel forward, as will be understood. The extending end, H, of the latch then strikes the lower edge of the slot in the bracket, K, so that any continued movement of the main lever will cause the latch to free itself from the levers, which will be returned by the action of a pair of weighted arms, mounted in a bracket attached to the bottom of the car. These arms carry a roller, which bears against the under side of the lever, A. When the operating lever

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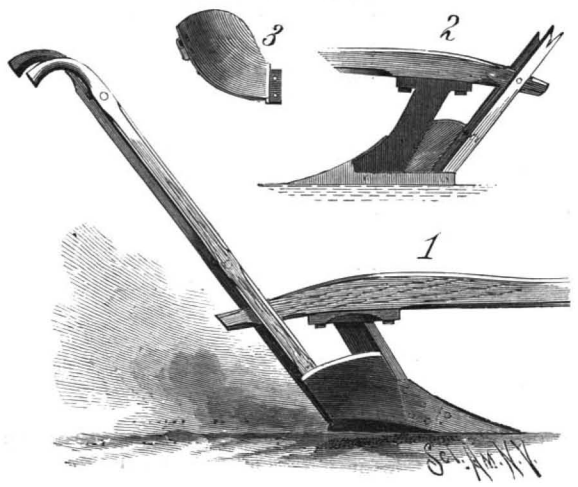
has been returned to a vertical position, the weights on the levers, G and H, will reset the parts, so that, by again moving the lever, an additional force may be applied to turn the wheels.

The braking mechanism consists of a rock shaft having arms carrying brake shoes. Rigidly connected to the shaft is a forwardly extending arm, L, which is coupled to the end of the lever, J. As the main lever is thrown to the right, the forward end of the arm, L, will be depressed, and the shaft rocked to carry the shoes against the wheels. The same mechanism operates brakes bearing against the rear face of the wheels.



NEVILLE'S COMBINATION PLOW.

Upon the main lever being returned, a weight carries the parts to their normal position. Further information concerning this patent, which is for sale, may be had by addressing the inventors, as above.

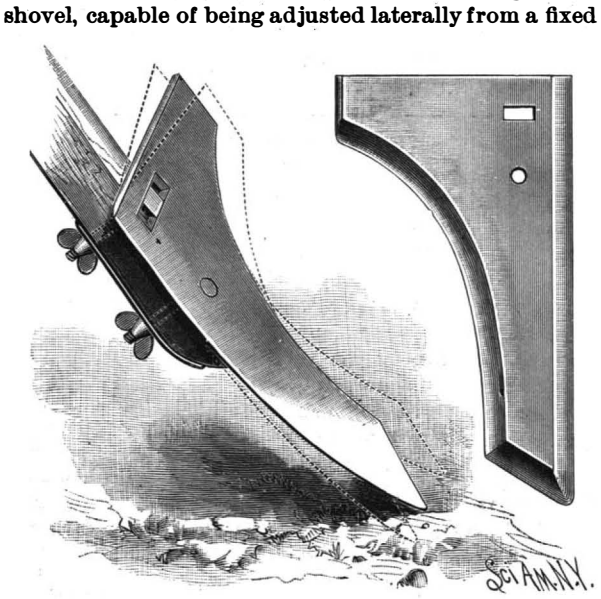
COMBINATION PLOW.

Upon the plow here illustrated either wooden or metallic mouldboards may be used interchangeably. The iron standard is bolted to the under side of the beam, there being a plate upon the upper end of the standard through which bolts pass. The standard projects downward and forward, and is provided with a flange, upon which rests the point, which is secured by a bolt and steadied by a rearwardly extending bar fitting in a recess in the standard, as shown in Fig. 2. Just back of the point is arranged a share, secured to the standard by bolts, and which projects upward beyond the flange upon the standard. The mouldboard, Fig. 3, has a flange fitting beneath the rear edge of the share, the extreme upper edge of the share abutting against a shoulder on the board. The handles of the plow are united by braces, one being beneath the beam; the landside handle is bolted to the rear end of the beam and to the rear end of the bar that steadies the point, while the lower end of the other handle is bolted to the mouldboard when the latter is made of wood. When the mouldboard is of metal, the lower end of the handle is stepped in a socket secured to the rear face of the board. Although a wooden mouldboard pulverizes the earth more thoroughly than one of metal, it is not always desirable to use the former, hence the need of a plow having interchangeable mouldboards.

This invention has been patented by Mr. S. S. Neville, of Burnsville, Miss.

CULTIVATOR TONGUE AND SHOVEL.

The engraving illustrates an invention which consists in a cultivator shovel, forming a combined tongue and shovel, capable of being adjusted laterally from a fixed



SANDERS' CULTIVATOR TONGUE AND SHOVEL.

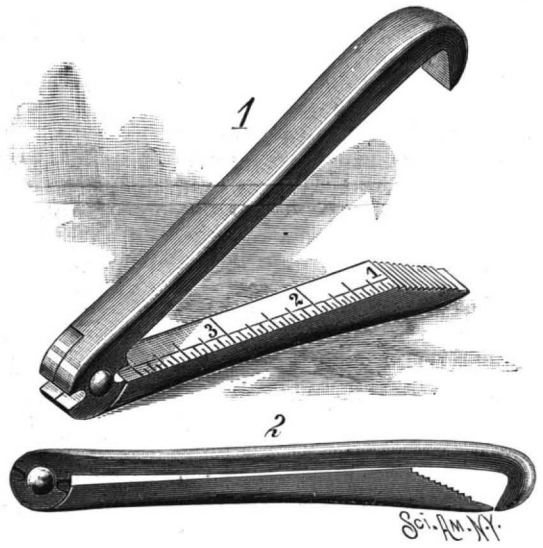
center or pivot. The lower part of the blade, which is shown detached in the right hand view, forms the tongue part, while the upper portion forms the shovel. The straight vertical edge is beveled on its under surface to form a cutting edge, which adapts the blade to first plowings. The lower angular end is also beveled to form a cutting edge, and serves to work the earth closer to the plant. The end being made slanting, a forcing action is exerted toward or from the plant. The outer edge is straight below, but spreads out laterally and upwardly in a curve, and is also beveled. This construction provides for the surface of the ground being cultivated without disturbing the roots of the plant. Above the curved portion the edge of the blade is rounded, the object being to prevent injury to the plant. The blade is secured to a standard by screw bolts arranged one above the other. One of these bolts rests in a countersunk seat formed in the sides of an oblong slot running in the direction of the width of the plate, to provide for the lateral adjustment of the latter from a fixed center formed by the other bolt. This adjustment of the blade, shown by the dotted lines, enables the operator to plow either close to the plant or away from it.

The blade may be used either with its straight side next the plant, as when the plant is small and requires the earth stirred close to it, but does not require the earth to be thrown toward it; or the shovel may be turned so that its curved edge will be presented to the plant, when the roots will be left undisturbed and the earth thrown toward it. The sharp cutting edges permit the shovel to be readily shifted while in the ground, and hence it can be more easily managed than if the edges were square and blunt.

This invention has been patented by Mr. James M. Sanders, of Morrisville, Ohio.

COMBINATION TOOL WRENCH.

This tool may be used as a hand and pipe wrench, wire cutter, wire nipper, screw driver, tack drawer, measuring rule, and for other purposes. The flat circular ends of the arms are connected by a rivet. On opposite sides of the rivet the circular ends are formed with notches, the outer pair of which form wire cutting edges, while the corners of the metal at the side of the other pair are rounded, to enable the arms to grasp wire for the purpose of stretching it without danger of cutting it. One arm is curved near its free end toward the other arm, and its extremity



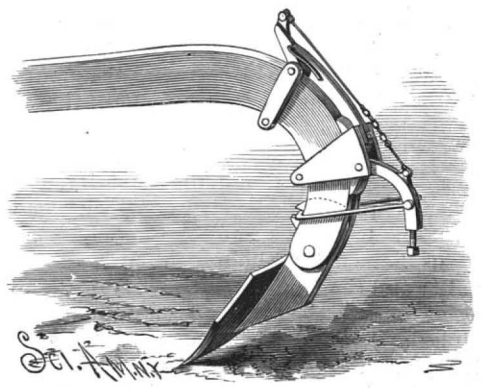
SPARHAWK'S COMBINATION TOOL WRENCH.

is provided with a chisel-edged angle hook, which is inclined toward the pivot. The other arm is thickened near its free extremity, curved outward and formed with sharp edged teeth inclined outwardly, and upon its extreme end is formed a screw driver edge. The inner faces of the arms are graduated into inches and fractions thereof, so that the device may be employed as a measuring rule. The hooked end is used for drawing nails and tacks and for engaging one side of a piece of pipe or a nut while being turned, the opposite side of the nut being engaged by one or more of the teeth on the end of the other arm. The screw driver is applied to a screw in the usual way, and the other arm may be employed as a lever for turning the screw. The arms fold compactly together, the screw driver edge coming directly opposite the edge of the hook. The outer corners of the arms are rounded, to permit of using the tool without injury to the hands, and also to prevent them wearing the pocket.

This invention has been patented by Mr. W. W. Sparhawk. Further particulars can be had from Mr. J. M. Marsh, of Scotia, Neb.

CULTIVATOR BEAM AND POINT.

The point shank is pivoted to the beam by a bolt. Attached to the beam is a spring, so arranged that it exerts a constant backward pressure upon the shank above its pivot. The spring thus holds the shank and point to their work until the pressure on the point overcomes the tension of the spring, when the point and point shank will spring backward and thereby lessen the pressure upon them. The lower end of the spring is attached to a yoke secured to the beam, and its upper end is held in a socket formed in a lever fulcrumed to a yoke on the beam, and is connected by a rod to a bent arm pivoted to the lower yoke. This arm is connected to the point shank by a coupling held in place by two lugs formed at the front edge of the shank above the point. In case the pressure upon the point is more than equal to the tension of the spring, the point will move backward, the shank moving forward. This movement will draw the bent arm forward and the upper end of the lever downward, and thereby increase the tension of the spring which, upon the removal of the pressure, will return the parts to their original position. In case of over-pressure, the bent arm will strike the back of the shank, and thus lock the lever and shank, so that no injury can be done the spring. The distance the arm moves is regulated by a set screw in its lower end. Should the point enter the ground too deeply or strike an obstruction, the shank will yield, so that the point will automatically run more shallow in the ground, or pass the obstruction



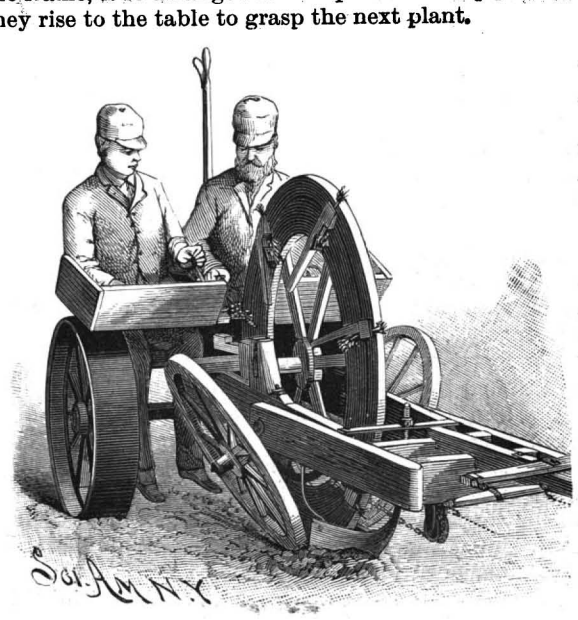
ADY & HAITH'S CULTIVATOR BEAM AND POINT.

without injury and without jerking the plowman or team.

This invention has been patented by Messrs. N. J. Ady and J. W. Haith, of Rockport, Atchison County, Missouri.

IMPROVED TOBACCO PLANTER.

The accompanying engraving illustrates a planting machine especially adapted for automatically setting tobacco plants, but also applicable for setting and resetting other plants or seeds. In the frame of the planter is journaled a large wheel which carries the plants to the ground. The forward end of the frame is supported by inclined wheels, which throw the earth back into the furrow and pack it around the roots of the plants. To the front of the frame is held the furrow-opening plow, which may be adjusted vertically to work at any required depth in the ground, and may be set nearer to or further from the plant-carrying wheel. The plow has a sharp nose portion to enter the ground easily, and has two rear wings which stand one at each side of the wheel to open a clean furrow somewhat wider than the tread of the wheel, and to protect the plant clamps, which are held to the right-hand side of the wheel rim. These clamps consist of clip blocks pivoted to lugs on the wheel, and pressed at their outer ends to or toward the wheel by springs. Behind the wheel is a plant-holding table having an opening, into one part of which the rim of the wheel enters, while in the other part is pivoted a plant-holding bed, upon which the plants are held in proper position to be seized by the clamps. To a hanger fixed to the frame is connected a plate, which is preferably elastic, against which the tails of the jaws of the clamps strike, to open them at the proper time for dropping the plants into the furrow. Another block, fixed to the frame, is so arranged as to open the clamp jaws as they rise to the table to grasp the next plant.



SIMMONS' IMPROVED TOBACCO PLANTER.

One of the clamps—the number of which is governed by the distance apart at which the plants are to be set in the ground—grasps a plant and carries it around forward until it is held, root downward, in the furrow. The clamp then opens, its tail striking the block, and the plant drops into the furrow, when the inclined wheels roll the earth back into the fur-

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row and pack it around the root of the plant, the earth being packed by the wheels harder at the base of the furrow than at the surface. This way of packing the plants prevents them from being washed out by rains, and at the same time allows the necessary moisture to pass freely to the roots. The plants are set in a little ridge above the ground level, making it easy to plow closely when cultivating them. At times, on soft ground, one of the inclined wheels may be dispensed with, when the earth will be pushed back into the furrow by the other, the plow wings being so arranged that the one next the inclined wheel in use will throw out most of the earth. By means of suitable lever connections, the three forward wheels may be lifted in turning the machine.

This invention has been patented by Mr. Andrew A. Simmons, of Greenvale, Ill.

The Jetties in a Storm.

The construction of the jetties at the mouth of the Mississippi River has proved to be one of the works the most ingenious in its nature and most valuable in its results of all our public efforts. The success is to-day as obvious as the sunlight, and the stupidity, ignorance, hatred, and professional rivalry which once raged with furious bitterness against Capt. Eads are hushed, let us hope not without penitence and shame to the guilty and the foolish. At the very outset the army engineers opposed the project as one founded on wrong principles and impossible of success. The lucid and frank explanation of Capt. Eads they were as unable to comprehend as the negro who blackened their shoes —another instance of the imbecility that is so often engendered by red tape. Then came the "outlet theory," a system so unscientific and fallacious that one almost blushes to-day to think that so many Americans could be brought to countenance it. Then followed furious red-hot shot from a portion of the press, whose fitness and intelligence are shown by the crude criticism and shallow assertion they uttered, either from ignorance or spite.

The Cincinnati *Commercial* was the big goose that led the cackle, and a train of silly ducks quacked to the *Commercial's* music. If a single fact more than such as were known was wanted to confirm the confidence now felt in the jetties, the late storm in the Gulf has supplied it. It has often been asked how the jetties would stand one of those overwhelming tempests that sweep over the Gulf at intervals of years. Such a tempest we have recently had, and the jetties came out of the conflict with which the hurricane forces assailed them stanch and victorious. The storm went beyond any to which the jetties had been exposed, beyond even the noted hurricane of 1883. Not only did the jetties at the mouth of the Mississippi withstand the might of the storm, but those at the Sabine, not half finished, did the same. They are built on the same system as the Eads jetties, and the might that held out at the storm was the same fragile-looking willow mattresses that are used there. Major Heuer, who has supervision of the work, has carefully examined what effect it has had upon the unfinished work. The New Orleans *Picayune* reports that Major Heuer "found the Sabine jetties entirely uninjured, and no material change in the depth of the channel between them. They had withstood the fury of a storm that had swept away every human structure upon the adjacent land."—*Memphis Appeal.*

Health of European Cities.

The *Revue d'Hygiene* for October 20, 1886, contains an interesting article by Dr. Bertillon, the Chief of the Statistical Bureau of Paris, on the comparative healthfulness of the principal European cities for the year 1885, from which we take the following notes:

Typhoid fever was more frequent in the French cities than in others. At Rheims it caused, per 100,000 inhabitants, 151 deaths, at Marseilles 149, at Nancy 133, at Toulouse 79, at Havre 74, at Paris 63, and at Lyons 42. In Brussels the proportion was 19, in Amsterdam 11, in Munich 18, in Berlin 17, in Leipzic 16, in Konigsberg 38, Dantzic 33, Hamburg 32, Vienna 14, Copenhagen 8, St. Petersburg 90, London 17, Manchester 21, Liverpool 31, Edinburgh 34, Dublin 55. In New York the proportion was 26, Brooklyn 23, Baltimore over 38, and Philadelphia 64 per 100,000 inhabitants.

On the other hand, scarlet faver has been less fatal in France than in other countries, the only French city in which it caused a notable mortality being Marseilles, where it was 23 per 100,000 inhabitants. In Leeds it was 63, in Liverpool 33, Glasgow 56, Dublin 50, New York 40, Brooklyn 54, Philadelphia 39, Berlin 32, Dantzic 61, and Christiania 131 per 100,000.

For diphtheria the figures are, per 100,000 inhabitants: Marseilles 98, Amiens 113, Nantes 97, Toulouse 65, Lyons 25, London 22, Liverpool 23, Glasgow 22, Edinburgh 17, Manchester 6, Dublin 8, New York 94, Brooklyn 77, New Orleans 59, Philadelphia 62, Berlin 155, Dantzic 150, Dresden 142, Leipsic 137, Munich 71, Strasbourg 55, Stockholm 122, Christiania 434, and Copenhagen 57.

The cause of death, which is of great interest for purposes of comparison of the healthfulness of different localities, if accurate figures could be given, is consumption, or rather tuberculosis, since in such comparison it is desirable to reckon all the deaths due to tubercle, whether it affects the lungs, brain, or other organs.

Unfortunately, the reports are not so given that such a comparison can be made. A disease is by no means always contracted at the place of death. On the other hand, a certain proportion of those who contract this disease in a large city go to their old homes in the country or to various health resorts to die, thus making returns for cities necessarily inaccurate. Taking the figures as given, however, we find that for each 100,000 inhabitants there die from phthisis in Havre 494, Lille 463, Paris 453, Nancy 361, Rheims 340, London 205, Berlin 346, Breslau 361, Hamburg 309, Dresden 390, Leipzic 363, Munich 415, Nuremberg 475, Vienna 677, Buda-Pesth 642, St. Petersburg 553, New York 371, New Orleans 394, and Philadelphia 298.

Cure for Diphtheria.

Dr. A. Brondel writes, in the *Bulletin General de Therapeutique* of Nobember 15, 1886, concerning the treatment of diphtheria by benzoate of sodium, and asserts that of two hundred consecutive cases he has not lost a single one. He admits the possibility of a mistaken diagnosis in some instances, but, even excluding fifty per cent on this account, he still has one hundred cases without a death. His method is as follows: Every hour the patient takes a tablespoonful of a solution of benzoate of sodium, fifteen grains to the ounce, and at the same time one-sixth of a grain of sulphide of calcium in sirup or granule. In addition to this the throat is thoroughly sprayed every half hour with a ten per cent solution of benzoate of sodium. This is done religiously at the regular intervals, day and night, but no other local treatment is employed. No attempt is made to dislodge the false membrane, and no penciling nor painting of the fauces is resorted to. Tonics are given and antipyretics are used when occasion calls for them. The nourishment consists of beef juice, tender rare meat, milk, etc., but bread and all other articles which may cause irritation of the throat are forbidden. The sick room is kept filled with steam from a vessel containing carbolic acid, turpentine, and oil of eucalyptus in water.

The employment of benzoate of sodium is not a new method in the treatment of diphtheria, for it has been tried and is recommended highly by Letzerich, Kien, Ferreol, and others. But this, of course, speaks so much the more strongly in favor of the remedy; and as Dr. Brondel's results were better than those obtained by others using the same drug, it is to be presumed that his method of employing it is the best.—*Medical Record.*

Antidotes for Poisonous Chemicals.

Many serious accidents, says the *Moniteur des Produits Chimiques*, happen or may happen, in consequence of a loss of time in the application of remedies in the case or absorption of, or burning by, such poisonous chemical products as are commonly employed in the industries. The following antidotes are recommended: 1. For phenic, sulphuric, muriatic, nitric, or nitro-muriatic acids, creosote, tincture of iodine, or phosphorus, use the white of an egg well beaten up in water, and a teaspoonful of mustard in warm water. In case sulphuric, "nitric," or muriatic acid has been swallowed, it is necessary to take lime mixed with as small a quantity of water as possible.

2. For chromic acid, the chromates, and colors that have chromium for a base, the compounds of copper, and such preparations as have antimony for a base (such as tartar emetic), and the compounds of mercury and zinc, use the whites of eggs in abundance, and, as an emetic, mustard, which, however, is useless if the poisoning has been done by tartar emetic.

3. For ammonia, soda, potassa, the silicates, and the alkaline hydrosulphates, use vinegar and afterward oil or milk.

4. For prussic acid and its salts, the cyanides of potassium and mercury, the sulphocyanides, oil of bitter almonds, or nitrobenzine, pour water on the patient's head or spinal column, and put mustard plasters on the sole of the feet and the stomach. Do not let the patient go to sleep.

5. For ether, petroleum, benzole, fruit essences, and concentrated alcohol, take strong mustard as an emetic, with much warm water, cold baths, and fresh air. Keep the patient awake.

6. For the compounds of baryta or lead, use mustard as emetic, with warm water, Epsom salts or Glauber's salts in water.

7. For arsenic and its compounds, use mustard, and dialyzed iron with magnesia, and, afterward, oil, milk, or mucilaginous liquids.

8. For oxalic acid and its salts, use lime or lime water, and afterward castor oil.

9. For nitrate of silver, use kitchen salt dissolved in water, and mustard as an emetic.

10. For the nitrous fumes from the manufacture of nitrate of iron, or of sulphuric acid, take acetic acid, as strong as can be endured, in small quantities at a time.

Paste for Labels.*

BY LEO ELIEL.

The formulas here presented, with samples, are not original with the writer, but have been in use by him for many years with entire satisfaction.

1. Gum tragacanth	1 ounce.
" arabic	4 ounces.
Dissolve in Water	1 pint.
Strain and add Thymol	14 grains.
Suspended in Glycerine	4 ounces.
Finally add Water	to make 2 pints.

This makes a thin paste suitable for labeling bottles, wooden or tin boxes, or for any other purpose paste is ordinarily called for. It makes a good excipient for pill masses, and does nicely for emulsions. The very small percentage of thymol present is not of any consequence. This paste will keep sweet indefinitely, the thymol preventing fermentation. It will separate on standing, but a single shake will mix it sufficiently for use.

2. Rye flour	4 ounces.
Powd. acacia	½ ounce.

Rub to a smooth paste with 8 ounces of cold water, strain through a cheese cloth, and pour into one pint of boiling water. Continue the heat until thickened to suit. When nearly cold add

Glycerine	1 ounce.
Oil cloves	20 drops.

This is suitable for tin or wooden boxes or bottles, and keeps sweet for a long time.

3. Rye flour	4 ounces.
Water	1 pint.
Nitric acid	1 drachm.
Carbolic acid	10 minims.
Oil cloves	10 minims.
Glycerine	1 ounce.

Mix the flour with the water, strain through a cheese cloth, and add nitric acid. Apply heat until thickened to suit, and add other ingredients when cooling. This is suitable for bottles, tin or wooden boxes, and will not spoil.

4. Dextrine	8 parts.
Acetic acid	2 parts.
Alcohol	2 parts.
Water	10 parts.

Mix dextrine, water, and acetic acid to a smooth paste, then add the alcohol. This makes a thin paste, and is well suited for labeling bottles and wooden boxes, but is not suitable for tin boxes.

Roses for a Small Garden.

Twelve dwarf plants may consist of three Gloire de Dijon and one each of Chestnut Hybrid, Abel Carriere, A. K. Williams, Baroness Rothschild, Captain Christy, Charles Lefebvre, Duke of Edinburgh, Victor Verdier, and Prince Camille de Rohan. For walls, I should recommend Gloire de Dijon, Aimee Vibert, Belle Lyonnaise, Bouquet d'Or, Devoniensis, and Jules Margottin. In this selection of eighteen plants, I have suggested planting four Gloire de Dijon, for the reason that it is, without doubt, by far the best outdoor rose grown, and will produce during the season more satisfactory blooms for cutting than any other rose—which, to my mind, is the chief object. Devoniensis is a more beautiful flower, especially in the bud state, but then the proportion of bloom is about one to six. Aimee Vibert, with its vigorous growth and beautiful foliage, clad in summer with a canopy of snow-white blossoms, is very beautiful, but still not to be compared in usefulness to Gloire de Dijon, which from May until November yields blooms of excellent quality, shape, and perfume. As regards stocks, have them on the common brier, and plant low, so that they may form "own roots."—*J. K., The Garden.*

Arkansas Coal.

Much has been said lately in the local newspapers regarding the valuable resources of Ouachita County, Arkansas. The most valuable discovery made in this section is the vast deposits of brown and cannel coals. These coal beds are situated on the Ouachita River, running on a line with the river about fifteen miles north of Camden, nearly to the Little Missouri River, a distance of ten or fifteen miles overland in length, and thence running west about six miles. A number of drifts have been made in various localities where the coal cropped out, showing a thickness of the vein from two and a half to six feet. During the late war many barrels of oil were extracted from this coal. The ruins of the old government reduction works are yet to be seen near the banks of the river, but the old drifts have all caved in. The coal lies embedded in rugged, high, hilly lands, and the veins run in a horizontal direction at the base of the hills, so that instead of sinking shafts from the surface, all that is necessary is to run horizontal drifts from the base of the hills in the valleys, where outcroppings are discovered. It is easy coal to mine, is of a superior quality for fuel and heating and steam making purposes.

* From a paper read before the American Pharmaceutical Association.

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Food Sophistications.

"There is no such thing in this city as the adulteration of articles of food, as a sanitary question," said Health Commissioner De Wolf, of Chicago, to an *Evening Journal* reporter who asked him to what extent our food supply was adulterated. "There is a sophistication of articles of food, and that sophistication is a commercial fraud, but that is all there is to it. The sophistication of cane sugar by glucose is not a sanitary question, for glucose is as healthy as cane sugar. The mixture of certain fruits with pepper berry to the extent of 8, 10, or 15 per cent is a fraud upon the consumer, but has no insanitary feature. So with the sophistication of all spices. The mixture of ground lemon shucks and ground cocoanut shucks with spices is commercially a fraud, but it does not affect the sanitary product. Coffees are sophisticated and adulterated to reduce the price, and the Rio coffee berry is by a process of roasting and polishing made to resemble the Old Government Java. Flours, the various preparations of oatmeal, and starch of all kinds, are neither sophisticated nor adulterated in any way in our city. The most our chemist finds in our milk is the addition of water or the removal of cream. There is occasionally found, however, in pickles, cooked and prepared for market, a slight trace of copper. This copper is used to give them the bright green tint. That is poisonous and is objectionable. It is probably true, also, that there have been times in this city within the last ten years when confectionery was colored with some salts which are highly objectionable, but I presume this custom has ceased. It is true, with the exceptions I have told you, there is no adulteration. It may be true that peas are used to sophisticate coffee.

"They make coffee berries out of them. That is getting to be quite an industry down in Connecticut, where they manufacture wooden nutmegs. That is a commercial fraud, but has no insanitary feature. I have heard, also, that honey was found in the comb in beautiful cuts, where neither the comb nor the contents had ever seen a beehive. The comb was manufactured out of paraffine, and the cells were filled with glucose, but that is not a sanitary violation. It is a commercial fraud, for honey is glucose. People prefer spices that are sophisticated. They won't buy and pay for spices that are pure. Some time ago a wholesale grocery firm sent out all through this community, at my request, spices that they guaranteed to be perfectly pure and free from any sophistication, and they only got one order, and that was from General Phil Sheridan. The rest of the people had rather pay nine cents a pound for pepper ground, when they know that the good berry cannot be bought for less than eleven cents, for they know that the adulteration doesn't hurt anything, and answers just as well. People in this city will not buy and pay for condiments which responsible firms guarantee to be free from sophistication. They prefer a sophisticated article at a lower price. In short, our great food products made up of the various preparations of flour, wheat, rye, oats, all our starches, and all kinds of flesh meat are perfectly pure."

Protect the Patent System.

All who are interested in patents should keep a watchful eye on Congress. At every session efforts are made to secure the virtual abrogation of the patent system, which, if not perfect in every respect, has aided in an important measure in placing the United States ahead of the rest of the world in inventions.

Just now the opponents of patents are urging the passage of Congressman Townshend's bill limiting the jurisdiction of the United States courts in patent cases and protecting innocent purchasers of patented articles. The advocates of this measure would convey the idea that the patent system is responsible for all the suits brought against infringers, and that infringers are an innocent set whom Congress should protect. This they would do by annulling the patents covering inventions which the public wish to appropriate without paying for them.

These persons say: "Certainly it is little enough for Congress to provide that such suits may not be brought against innocent purchasers, who act in good faith and with no notice or knowledge that the patent is an infringement." Such a sentiment may sound well to the thoughtless, but its absurdity is too apparent to escape notice. An inventor is not likely to devote years of thought and all his means to produce some great improvement which anybody may appropriate without rewarding him, unless, forsooth, he sends a messenger or writes a letter to every mechanic and every farmer in the country, to announce his discovery and warn them against appropriating the fruits of his genius.

The advocates of such a policy will next be saying that a man who has purchased a horse "in good faith and with no notice or knowledge" that it is stolen, should not be compelled to give it up; or that a bank should be compelled to cash a forged check because the person who presents it gave money or goods for it "in good faith and without notice or knowledge" that the check was forged.

The injustice of such a course is evident to all. Protect the inventor in his rights.—*The American Artisan.*

Celluloid.

BY SAMUEL P. SADTLER, PH.D., PROFESSOR OF CHEMISTRY, UNIVERSITY OF PENNSYLVANIA, U. S. A.

The material which is now generally known under the name of "celluloid," although known too as "zylonite," was first prepared by the English inventor, Alexander Parkes, about 1855, and introduced by him to the world under the name of "parkesine." His method at first consisted in preparing nitro-cellulose, or pyroxyline, by treating some variety of pure cellulose to a bath of mixed nitric and sulphuric acids, in which it undergoes the chemical change known as "nitration," and is converted into nitro-cellulose. Parkes then dissolved it in liquid solvents, like wood naphtha, mineral naphtha, nitro-benzol, or glacial acetic acid, and then driving off the solvent by evaporation, or precipitating the pyroxyline out of the solution as a semi-solid, curdy mass, which is then pressed and dried. Later, he adopted the use of an alcoholic solution of camphor for the solvent. Indeed, Parkes and his successors stated that all the ordinary volatile solvents are improved by the addition of camphor. Parkes abandoned the manufacture in 1867, on account of the difficulties in its manipulation, although he made a fine exhibit of his products at the Paris Exposition in 1867, obtaining a prize medal therefor.

Daniel Spill, also an Englishman, in 1869 revived the use of one of Parkes' methods, and, indeed, got a patent for the use of camphor or camphor oil, in connection with alcohol, as a solvent for the pyroxyline; but his American patent was afterward declared valueless by Judge Blatchford in a suit brought by Spill against the Celluloid Manufacturing Company. After the failure of Parkes, the first inventor, in making a merchantable article, no new discovery occurred in the matter until the Hyatt Brothers, then of Albany, N. Y., after considerable experimenting, found that solid gum camphor, when in the melted state, became a perfect solvent for the pyroxyline, so that, by thoroughly mixing the comminuted pyroxyline with camphor and heating, the mass became perfectly homongeneous and plastic. This discovery was patented in America, July 12, 1870, and reissued June 23, 1874, in an improved form, and constitutes the basis of the present manufacture by the Celluloid Company, of Newark, N. J. The only other manufacturers of similar products in America are the American Zylonite Company, of Adams, Mass., who were the defendants in a suit brought by the Celluloid Manufacturing Company for infringement of their patents, and against whom a decision was given by Judge Shipman, of the United States Circuit Court, in March, 1866, and reaffirmed in a second decision in July, 1866.

In England, the British Zylonite Company manufacture a similar product to that made by the American Zylonite Company, and, as I am informed, under similar patents. In France, there is only one manufactory of celluloid, at Staines-on-the-Seine, which is running under license of the Celluloid Manufacturing Company. In Germany, works were started by a Hanover firm, but were abandoned because of the explosive character of the material.

In the process of manufacturing celluloid, as carried out in America, a very pure form of cellulose is taken, preferably a tissue paper, which is prepared in large rolls by the paper mills especially to the company's order. This, after nitration, undergoes a thorough washing, and then a partial drying. To a weighed charge of this is added the necessary amount of camphor, and the two are then thoroughly incorporated and ground in suitable machines. A coloring pigment may also be added at this stage. The ground mass is then moistened with a small amount of alcohol, not that it is needed for solvent purposes, but merely to agglutinate it, and to allow of its being worked at a slightly lower temperature. It is then put into frames, and submitted to powerful hydraulic pressure for some time. The cakes so obtained are broken up, and the broken material is ready to be fed between the heated rolls, which are to complete the change of the material into what in the future will be known by the name of "celluloid." This is the celluloid "stock," as it may be called. It may be made transparent, translucent, dead white, or colored with a variety of pigments. It may be of uniform color and appearance, or it may be stratified and veined, so as to produce the imitations of ivory and amber, tortoise shell, coral, and ornamental stones. It may be rolled or cut into thin sheets, or it may be drawn into fine rods or tubing.

Its applications at the hands of the American Celluloid Manufacturing Company and their licensees are almost innumerable. Thus, among the earlier applications of this new material were the manufacture of celluloid brushes, combs, and hand mirrors, for which purpose it has almost completely replaced ivory and ebonite, as the celluloid brushes never lose their backs from immersion in water, nor do combs break by falling. They may be scoured and cleansed without fear of warping, and will withstand the chance careless usage of children. In the same way, celluloid collars and cuffs have been known for some years as excellent imitations of the best laundried linen, and possessing special advantages for travelers and tourists in the ease with which they may be cleansed.

But numerous applications have been found in the last few years for this material, some of which are, no doubt, destined to totally change the present condition of important industries. The very perfect imitations of ivory, amber, agate, and fancy marbles now made of celluloid have led to its use as an excellent material for the handles of knives and cutlery, as well as for umbrella and parasol handles and similar fancy articles. It is superior to ivory, in that it will not crack or become yellow with age, and to amber and precious stones in its ability to stand a sharp blow or fall. It is replacing ivory, moreover, in two quite dissimilar uses. It is used now almost exclusively in America in the manufacture of piano keys, as an entire key board can be finished to look perfectly uniform and true in shape and color—a thing extremely difficult with ivory, and, with the increasing scarceness of this material, likely to be more difficult in the future; and in the manufacture of billiard balls it has great advantages over ivory. It can be given any desired density and hardness, and its density will be absolutely uniform throughout the sphere, thus making the ball much truer in the hands of a skillful player.

Among the other applications of a more or less promising kind that have been found for celluloid in recent years, are the use of it for harness trimmings, as it stands exposure to snow, sleet, rain, and blistering sun, as well as frequent washing, and gold and silver can be worked in the ornamentation without the metal tarnishing by sulphur contact, an annoyance inseparable from other mountings; for the manufacture of emery wheels, which, with this material as the base, have proved to be superior in action and more durable than all other wheels; for covering corset steels, and trusses and surgical supporters; for plates for artificial teeth, in which use it has largely superseded hard rubber and metals, being stronger and healthier than the first and lighter than the second; in the manufacture of rims for eyeglasses, as they are light and strong, and do not rust or corrode; in the manufacture of letters for window and indoor signs, and of figures for street numbers; for veneering on wood in the manufacture of show cases and ornamental frames; and for various fancy articles, like furniture casters, etc.

An application that is now being developed is in the manufacture of stereotype plates for printing. Where printing is done on cylinder presses at high speed, durability and clear impressions have not been hitherto combined in one material. The difficulty has been that metal plates soon become illegible, and to replace them involved large expense. In these respects celluloid plates are much superior to metal. They give, when new, an equally sharp impression; when worn out, they can be replaced at much less cost, and, where emergency demands haste, they can be made in a part of the time required to put metal plates through the processes necessary to their production. One-half hour will suffice for casting and blocking a plate. The plates are light and convenient to handle. They are tough and elastic. Consequently they do not batter easily, like metal, and require no wrapping when sent through the post. This advantage is important, both as to saving of time and material in wrapping, and saving of postage in transmission. They take ink freely, and on cheap paper give a sharper impression than with the care ordinarily used by pressmen can be obtained from electrotypes. And for printing with colors, it is vastly superior to wood type or wood cuts. With celluloid a line may be worked in green or red, removed from the form, its face in a moment made as fresh as when new, and again immediately worked in another color. No time is lost in drying its surface, as it absorbs neither the lye, benzine, nor water. The celluloid adheres closely to the grain of its wood base, enters into its fiber, and becomes a part of the block itself, rendering detachment impossible. The rapid advances made in the application of this most interesting chemical product leave no room for doubt that it will play a very important part among the materials of construction in many manufacturing and technical processes in the future.

Top and Bottom Flanges of Wrought Iron Beams.

It is obvious that if twelve tons per square inch were the ultimate tensile strength of wrought iron, such beams should have the same quantity of material in both their upper and lower flanges. This is, however, not the case; the ultimate tensile strength is considerably greater—viz., nearly twenty tons—while the ultimate compressive strength is sixteen. The top and bottom flanges should thus be in the proportion of sixteen to twenty, or four to five, *i. e.*, the bottom flange should be four-fifths of the top flange for both to fail simultaneously, which is just the reverse of cast iron, where the lower flange is required to be six times greater than the upper on similar grounds. With wrought iron work, where riveted plates are used, the bottom alone is weakened by the rivets passing through the plates, the top remaining uninjured as regards compression, and on this account (neglecting the rivets in the calculation) little difference is practically made in the area of the top and bottom flanges of such girders.—*Edwin Clark, in the Architect.*

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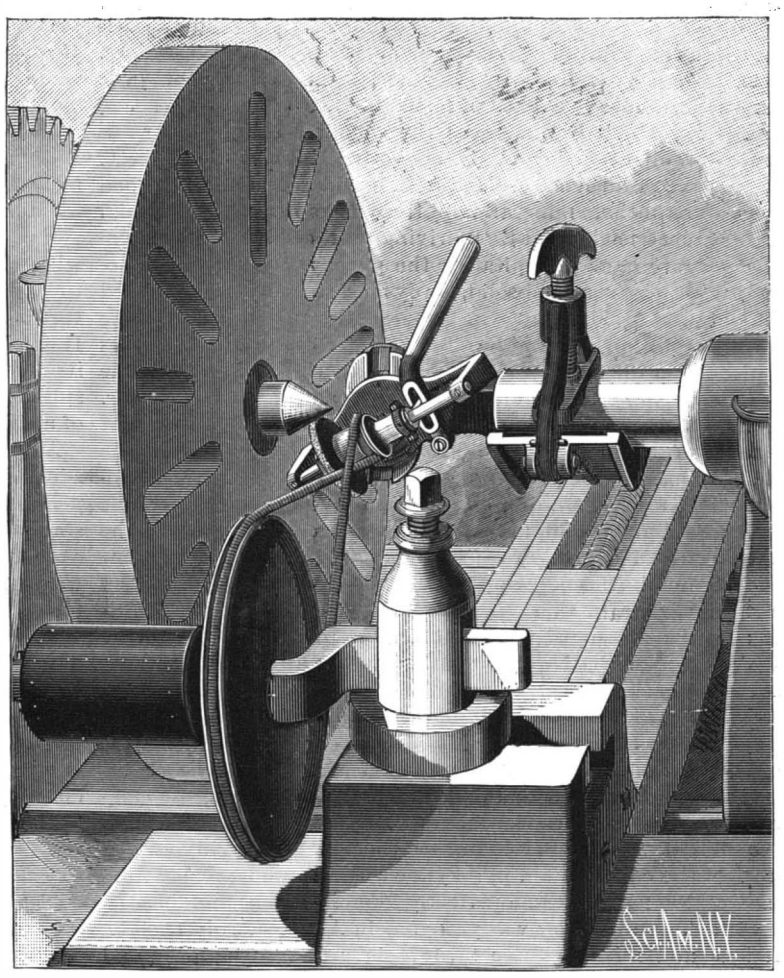
LATHE CENTER GRINDING MACHINE.

The frame carrying the grinding device has at one end a V-shaped socket, applied to which is a detachable clamp yoke, provided with a set screw bearing upon a clamp plate. The frame is held firmly upon the puppet head spindle, which enters the socket, when the set screw is tightened. As the socket is drawn up against the under side of the spindle, the true centering of the frame is insured, irrespective of the diameter of the spindle. Pivoted to the main frame by a bolt is a second frame, having end lugs, in which is mounted a spindle provided with a sleeve carrying a pulley and grinding wheel, the latter being made of emery, and being secured to the sleeve by a nut. Adapted to a groove in the sleeve is a two part ring formed with a pin projecting into a slot in a lever pivoted to the second frame. This lever has a handle by means of which a longitudinal movement can be imparted to the sleeve. Rotation of the ring with the sleeve is prevented by the projection of the pin into a slot formed in the frame. This frame can slide vertically on the other, which is formed with suitable grooves and a slot for the passage of the pivot bolt. In the second frame is a segmental slot, through which passes a bolt screwing into the first frame. The construction permits the second frame to be adjusted on the pivot bolt to different angles, depending upon the taper of the center being ground. The extent of the vertical movement of the frame is governed by the diameter of the center pin.

The grinding wheel is driven from the face plate in a very simple and efficient way. On a spindle, having a projecting arm adapted to the usual slotted tool post secured to the slide rest of the lathe, is a V-shaped pulley, having a long hub carrying a friction drum which is in contact with the periphery of the face plate. A belt passes around this pulley and the one on the sleeve. By turning the usual transverse feeding screw controlling the slide rest, the friction wheel can be moved into or out of contact with the face plate, the rotation of the grinding wheel being thus started and stopped at the will of the operator without stopping the lathe. It will be seen that the adjustment of the grinding disk to the diameter and angle of the center pin is effected without any corresponding adjustment of the driving device. It is apparent that the attachment can be readily applied to the lathe. It is properly centered when the clamp is tightened on the projecting spindle of the puppet head, and no further adjustment is required except that necessary to bring the grinding spindle to bear on the conical end of the pin and regulate the angle of traverse of the grinding disk to agree with the angle of the pin.

This invention has been patented by Mr. Alfred H. Randall, of 607 Franklin St., Philadelphia, Pa. This patent is for sale.



RANDALL'S LATHE CENTER GRINDING MACHINE.

ELECTRICAL TRANSMISSION OF POWER TO A DISTANCE.

The question of the transmission of motive power to a distance has recently deeply engrossed the attention of the scientific world and of the public, and a new element has been added to the study of this interesting problem by the late experiments of Mr. Hippolyte Fontaine. Before making known the results of these, we shall give a historic summary of the question from the standpoint of the applications made.

We cannot give the exact origin of the *idea* of transmitting power to a distance by electricity, but the first experiment in this line dates back to 1873, and was performed at the Vienna Exposition. The projector of this experiment, Mr. Fontaine, thus describes it in the *Revue Industrielle* (1873, p. 658): "The Gramme machines gave rise at Vienna to an experiment that will possibly be followed some day by very important applications. The first machine was actuated by a gas motor, and the electricity produced was sent into a second machine, which actuated a small centrifugal pump. As we had no measuring apparatus, it was not possible to determine the useful effect. Yet these first experiments have demonstrated not only the possibility of transmitting power to a long distance, but have shown that the performance is notably greater than that given by other apparatus."

Mr. Fontaine thinks that the power transmitted was one-third horse and the distance about 7 ohms.

On the 3d of December, 1886, the same gentleman gave an account, as follows, of the progress of this then nascent industry before the French Society of Physics:

"At Philadelphia, in 1876, the Gramme Society exhibited a transmission of from 2 to 3 horse power traversing a distance of 20 ohms.

"At Paris, in 1878, the same house exhibited a genuine distribution of power, where the same generator actuated, simultaneously or separately, a pump, a blower, and a printing press.

"None of these public demonstrations succeeded in attracting the attention of manufacturers to the new method of transmitting power; and it required the great experiments in plowing by electricity at Sermaize, in 1879, by Messrs. Chretien and Felix, to bring the question into the domain of practice. The Gramme machines used by these gentlemen revolved 1,400 times per minute, and produced a current of 20 amperes and 400 volts.

"Starting from 1879, the industrial applications rapidly increased, and, at the Exhibition of Electricity in 1881, there were to be seen more than fifty machines employed in electrical transmission."

Dating from the exhibition of 1881, we no further count the applications made in different quarters (always with the concurrence of the Gramme machine, or machines of that type), with the object of transmitting power to medium distances.

The difficulty increases with the distance of the transmission, or, more accurately, with the resistance of the line which connects the generators and receivers. It becomes necessary, therefore, in order that all the electrical energy shall not be spent in the line, to reduce the intensity of the current and increase the initial tension, as was pointed out as long ago as 1879 by Messrs. Thomson and Houston, in the *Journal* of the Franklin Institute for January of that year. After well explaining the necessity of using these high tensions, Messrs. Thomson and Houston conclude thus:

"Divested of these theoretical considerations, the important fact remains that with a cable of very limited section an enormous mechanical power can be transmitted to a considerable distance. The combustion of coal at the threshold of the mine, and the transmission of the mechanical power produced by rivers, may, then, be considered as applicable, the fact always being remembered, however, that a loss of 50 per cent will be almost inevitable."

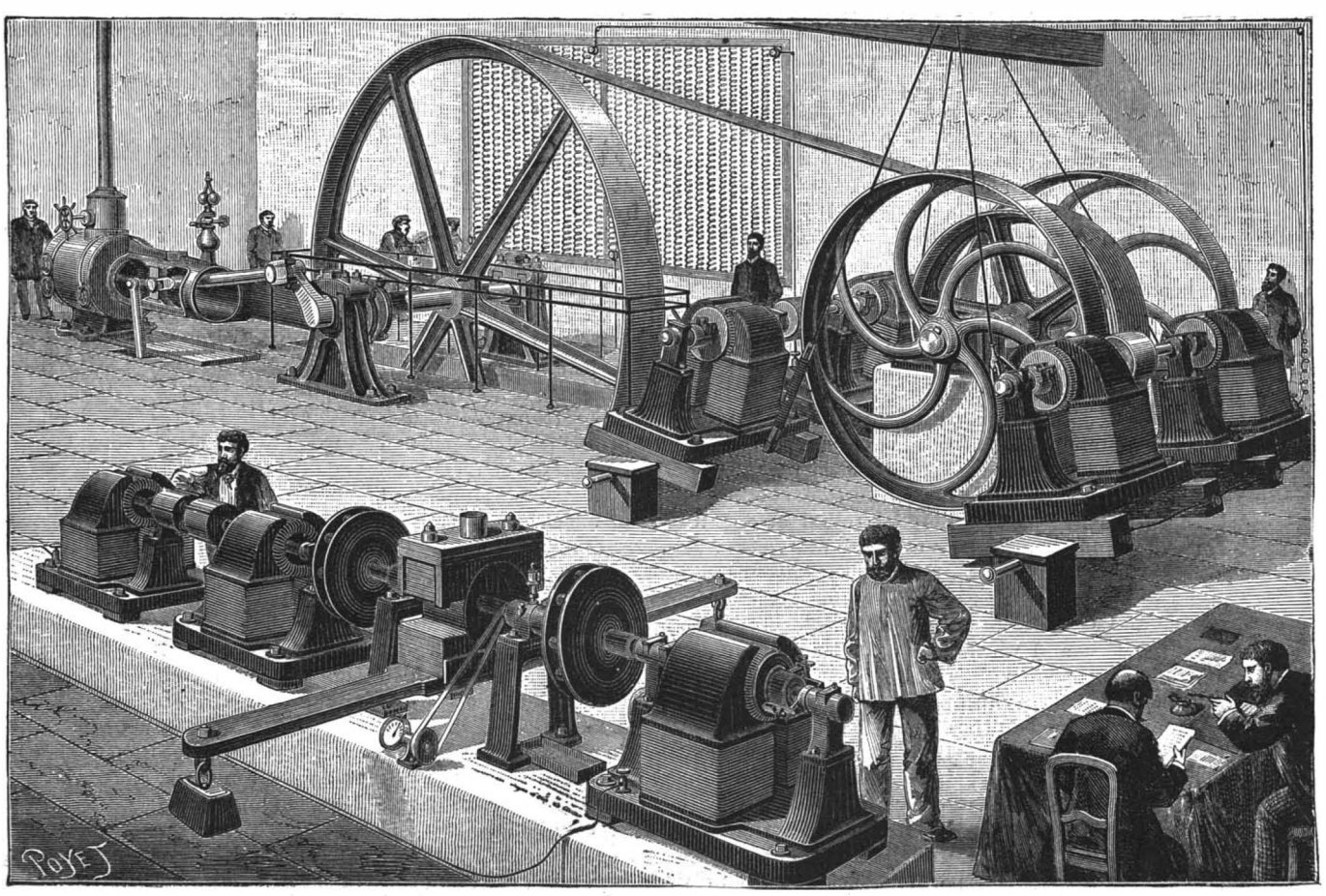
This prophetic figure of 50 per cent is to be remarked, for it makes its appearance approximately in most of the experiments that have been performed up to the present, without any one being able to sensibly exceed it.

But the error of Messrs. Thomson and Houston that we think it well to dwell upon, since it is still too widespread, is relative to the utilization of rivers, waterfalls, and, in a word, of natural motive powers, to a distance; and our opinion upon this point agrees with that of Mr. Fontaine, who cannot be accused of not having a certain amount of practical knowledge of the subject. We continue to cite:

'Mr. Hippolyte Fontaine does not believe that the utilization of waterfalls to a distance is as advantageous as has been often said. Taking into account the expense of setting up the hydraulic motors and dynamos, of the construction of dams and sluices, and of keeping in repair, and the interest on the capital invested, and the performance of the dynamos, etc., we quickly reach a total expense that is greater than that occasioned by a steam engine of the same power, especially when we reckon in the cost of the fall itself, which rarely wants an owner. The question, when looked at from the standpoint of transmission, is entirely another affair. In this case, the intervention of electricity presents numerous advantages over the systems now in use."

We may naturally ask, then, why the experiments that we are to describe were undertaken, seeing that their projector did not himself believe in their industrial success. Another extract from his communication will explain this:

"Although Mr. Fontaine undertook some new experiments on transmission to a great distance, it was merely to



ELECTRICAL TRANSMISSION OF POWER TO A DISTANCE.

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demonstrate that the machines constructed by Mr. Gramme are lighter, cheaper, and better, from every point of view, than those recently experimented with on the Railway of the North."

These reservations made (and we see how necessary they were), we may go on to describe the experiment performed by Mr. Fontaine, with the concurrence of Messrs. Nysten, Dehenne, and Chretien, at the Electric Company's laboratory.

The transmission was effected by means of seven machines of a unique type called "Superior," manufactured by the inventor, Mr. Gramme. Four of these served as generators and three as receivers. Each of them developed, at its normal angular speed of 1,400 revolutions per minute, an electromotive force of 1,600 volts and a current of 10 amperes. The four generators, excited in series, were mounted for tension, with three receivers mounted in the same way with a resistance of 100 ohms. The resistance of the armature was 4·75 ohms and that of the inductor 6·5 ohms, say about 179 ohms for the resistance of the circuit.

EXPANSION OF WATER.

The four generators (in the back part of the engraving) received their motion through the intermedium of two friction pulleys mounted on a shaft actuated by the engine belonging to the works. These machines oscillated upon an axle placed beneath their base; and springs regulated the pressure of the friction rollers against the driving pulleys. It was an improvement on the system employed at Sermaize in the experiments in electric plowing.

At the receiving station (foreground of engraving) the three Gramme machines were mounted in a line and connected by coupling plates of the Raffard system. The mechanical power developed was measured by means of a Prony brake placed between the first and second machines. The total weight of the seven machines was 18,480 pounds, and their total cost was $3,300.

The following table summarizes the chief conditions of the experiment performed on the 19th of October, 1886:

Speed of Gramme generators, 1,298 revolutions per minute.

Difference in potential at the origin of the conducting line, 5,996 volts.

Intensity of the current, 9·34 amperes.

Power received by the driving shaft, 95·88 horses.

Speed of receivers, 1,120 revolutions per minute.

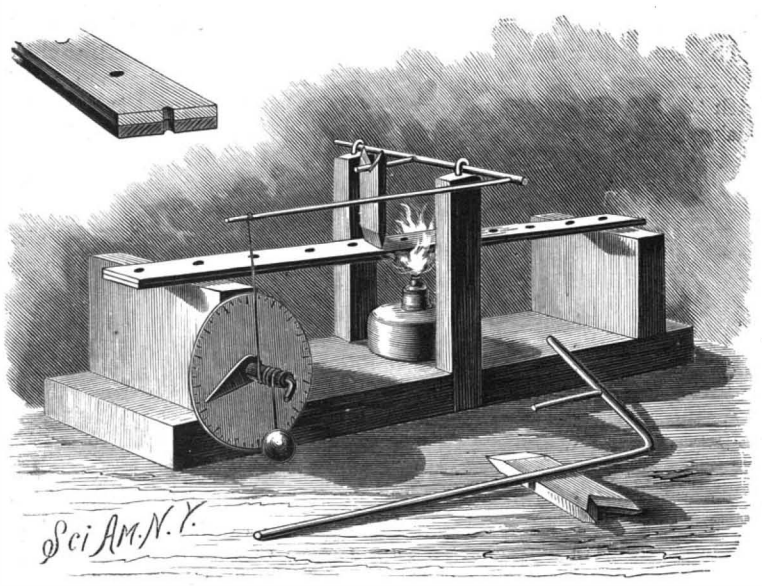
Power collected at the brake, 49·98 horses.

Industrial performance, 52 per cent.

The information gained from these experiments is that with seven Gramme machines of an ordinary type, weighing together about nine tons, and costing $3,300, it is possible to transmit a utilizable mechanical power of 50 horses through a resistance of 100 ohms, with an industrial performance of 50 per cent. But to conclude from this that material forces can be utilized to a distance of 30 miles is another matter. In fact, it does not suffice to produce this motive power at a distance, it is also necessary to distribute it, if we may be pardoned the expression, in several distinct packages, each operating independently of the others, and with a satisfactory performance.

Up to the present the problem remains intact. We do not by this mean to say that it is insoluble (the rational use of accumulators would cause many difficulties to disappear), but that it is not yet solved; and none of the experiments made in recent years shows an acceptable solution of it, since we cannot admit as practical the system that consists in actuating through the general transmission an electric generator, which in its turn sends the current into other receivers, thus interposing four transforming apparatus between the first motor and the utilizing apparatus, and reducing the performance to 15 or 20 per cent.

It is therefore necessary to make a distinction, and an important one too, between the transmissions and distributions to a slight or medium distance that have passed into industrial practice, and of which numerous applications may be cited, and transmissions to a great distance, with high tensions, for the purpose of utilizing those natural motive powers so improperly styled gratuitous. It is not necessary to enter into any great calculation to demonstrate that, in most cases, the best transmission, from an economical standpoint, is that by coal. This is the material that, for the many years still in store for it, will most simply and cheaply effect the transmission and distribution of motive power to great distances.—*E. Hospitalier, in La Nature.*



THE COMPOUND BAR.

EXPANSION OF SOLIDS, LIQUIDS, AND GASES.

T. O'CONOR SLOANE, PH.D.

The fact that solids expand when heated having been shown, the unequal expansion of different solids when subjected to the same degree of heat should next be illustrated. An old-fashioned piece of apparatus, the compound bar, is generally used for this purpose, composed of a strip of brass riveted to a strip of iron. Each piece may be ten inches long, five-eighths inch wide, and one-eighth inch thick. A rivet every inch holds them firmly together. If such a bar is heated, the brass expands about one-third more in lineal direction than iron. As the two are rigidly connected, the only way in which this condition can be fulfilled by the components of the bar is by bending. The iron and brass bend, the brass following the outside of the curve, or position corresponding to the outer and longer arc.

While this apparatus is very sensitive, owing to its absence of lost motion, all parts being solidly connected, its movements have the disadvantage of being very small in extent. After a high temperature has been reached by five minutes' heating in an alcohol lamp, a straight-edge has to be held upon the bar to show the curvature. This is always unsatisfactory. Not only is it hard to be seen by many observers at once, but, owing to the heat of the bar, it is far from pleasant to hold the straight-edge in contact with it.

In the cut, a modification, as it may be termed, of the apparatus used for illustrating the expansion of metals is shown adapted to the compound bar.

The base and two end standards are preserved. At the center of the base two higher upright pieces are placed. A bent wire runs across the top of the wooden uprights and is attached thereto by staples, or passes through holes bored through them. Instead of a bent wire, one of which is shown lying in front of the apparatus, a straight piece just long enough to reach across may be used. In that case, a longer piece passes through a hole drilled in its end, so as to represent the arm of the other piece. In the center of the transverse portion a hole is drilled, and a piece of wire is soldered therein. This piece should be about two inches long.

The relative sizes of the wires are largely matters of judgment. The cross piece may be about one-eighth inch, and the others one-sixteenth inch thick. The long arm is provided with a thread and weight, which are attached to its end. The thread is wound two or three times around the tubular axis of the index.

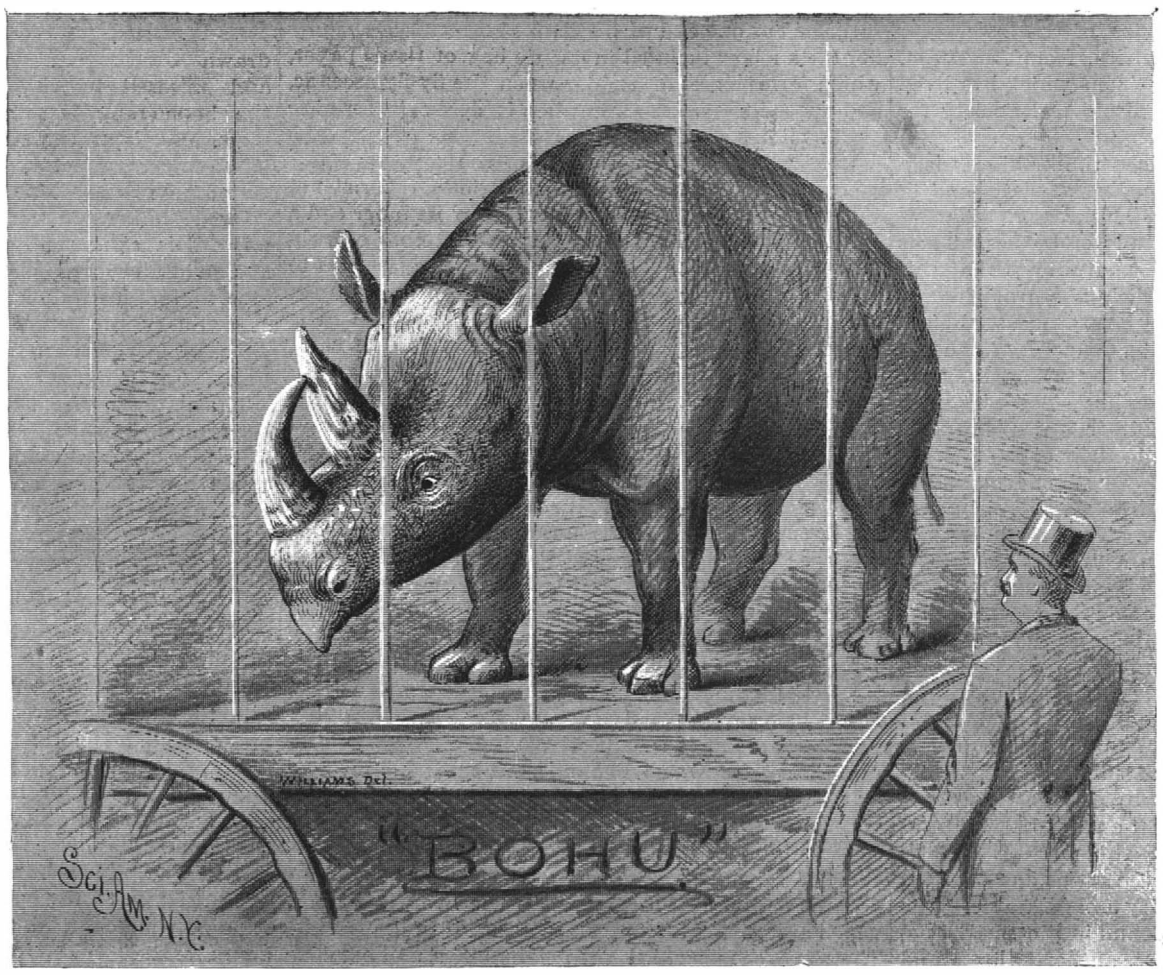
The compound bar is placed loosely over the base, resting on the two end uprights. A small piece of metal or even of wood of the general shape shown in the cut is placed vertically, one end resting on the center of the bar and the other end supporting the short arm of the wire above it. Now, it is clear that the least elevation of the center of the bar will raise the end of the short as well as long arm of the wire, and so will move the index. The bar can be lifted by hand to prove this, when the index will immediately begin to rotate.

All being thus prepared, a light is held under the center of the bar. It may be a lighted match, or an alcohol lamp may be used to better advantage. The instant that heat is applied, the index begins to rotate, and continues for some time to do so until the bar has acquired the final temperature due to the heat applied. Then all remains at rest.

The great sensitiveness of what is usually regarded as a very sluggish piece of apparatus is thus well exemplified. An experiment that generally requires five to ten minutes' time for an unsatisfactory demonstration is here carried out in a most effective manner in a few seconds.

The expansion of liquids is shown in all alcoholic or mercurial thermometers. It may, by the very simple apparatus next illustrated, be shown to an audience.

A small round-bottom flask is provided; a perforated cork and long glass tube that fits it tightly are adapted to the neck of the flask. Now, if water is introduced into the flask, and is heated, bubbles will gradually appear, due to separation of dissolved gases, principally nitrogen or carbonic acid gas. These would interfere with the demonstration, which should be carried out with a perfect liquid. Some water, therefore, is boiled



THE RHINOCEROS IN THE PARK.—[For description see next page.]

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for ten minutes, is cooled, and the flask is filled to the brim with it. The tube is inserted in the cork, so as barely to reach through it. The cork is now inserted in the flask, when water will rise a short way in the tube. It should stand only an inch or two above the cork. If it stands too high, the cork should be removed and replaced, less water being introduced into the flask. Absolutely no air must be inclosed. On heating the flask, the water will very slowly rise in the tube as the heat expands it.

The minor point of boiling the water should be attended to, as the effect is much better, and the demonstration is a true one, when no bubbles are discernible.

The same flask and tube may be used to show the expansion of gases. It is emptied, and inverted with the end of the tube under water. On heating the flask with a lamp, the air expands, and escapes in bubbles from the end of the tube. On removing the source of heat the water rises into the tube, and perhaps into the flask, owing to the contraction of the air as it cools.

THE RHINOCEROS IN THE PARK.

Bohu came to the Park only a short while ago, and is of that kind of rhinoceros which has two horns. Those of Asia have only one horn, and their skin lies in thick folds and segments, in shape like that of the armadillo. Nor are they by any means so rare as the one we have in the Park. As will be seen by the picture given of Bohu, drawn by our own artist, the upper lip of this strange beast is much larger than the under one. It is prehensile, that is to say, it can be made to curl about a branch or a wisp of straw, like the end of an elephant's trunk and with quite as much ease. Bohu is in the lion house, and at one end of it. The hippopotamus is at the other. This gives those who like to study animal life a fine chance to compare two rare forms, often mistaken, the one for the other. The last named, as will be seen by a visit to the Park, looks like a great hog in more ways than one. He has a blunt snout, short, thick legs, knows no such thing as grace when he moves, and to wallow is his chief delight. The rhinoceros, on the other hand, though in some ways like the hippopotamus, differs in these respects. It is more comely, or, rather, it is less hideous; its legs are long, its snout sharp, it does not need water to lie in, can stand for a long time, and walks with a free motion.

Bohu is still housed in the circus wagon which has wheeled her from town to town, over highways and country roads, for more than a year, and its keeper told the writer that when, during her pilgrimage, she caught sight of a fine wooded slope with verdant foliage and velvety grasses, she was sure to "make a break" to get out; for the rhinoceros takes the same pleasure in roaming over a wooded hill that the hippopotamus does in wallowing in muddy, sedgy river bottoms. Unlike the river hog, however, the rhinoceros is at times fierce, and visitors to the "show" of which Bohu formed a part had to be warned not to come too near, and it was not thought safe to let any other than her keeper enter her cage.

She belongs to the family *Rhinoceros bicornis*, has, as the name indicates, two horns on the snout, one almost straight, the other curved, and a narrow, compressed, deep symphysis, or union, of the lower jaw. She came from the north of Africa, from Abyssinia, and is said to resemble the specimen which has lived in the gardens of the London Zoological Society for nearly twenty years.

In their native wilds the rhinoceri, like bison, sleep during the heat of the day, feeding at night and in the early morning on leaves and the succulent branches of the trees and on certain kinds of bushes. Their sight is bad, and it is thought by naturalists that this comes, at least in part, from their nocturnal habits. They make up for this defect by a very keen scent, and are otherwise aided in escaping danger by feathered friends, called "rhinoceros birds," by which they are usually accompanied while roaming. These birds, at the slightest alarm, run about their heads, flap their wings, and screech a warning into their ears.

When frightened, they go off at a sharp trot, and, if danger really menaces, break into a gallop, but are easily overtaken by a good horse. The broad-nosed, or Asian, variety invariably run in a straight line, and it is said that all the hunter has to do to bring one down is to ride ahead, take a position to one side of the course followed, and let fly at short range as the beast goes by. The prehensiled lipped, or African, variety, however, will change his course when he sees the hunter close at hand, and is not, therefore, so easily brought down.

A strange habit of this kind of rhinoceros is the guiding of the calf when in flight by pressing the horns against its flanks, as if goading it on and steering it at the same time. The meat of the rhinoceros is said by hunters to be very good during the spring and summer, the rump being particularly juicy and palatable. The remains of the rhinoceri were found in the earliest deposits of this continent, and an authority has found reason for the belief that it made its first appearance here. He says:

"In the Eocene formation of the Rocky Mountains are found many modifications of the primitive perissodactyle (odd-toed) type, from which the rhinoceros may have originated, and various existing and distinct species and groups in a family, Rhinocerotidæ, which is a division of the perissodactyle section of the great order of *Ungulata*, or hoofed mammals, of which section the only other surviving members are the tapirs and horses."

SCIENCE IN TOYS.

IV.

The ascensional power of heated air is exhibited by the draught of every chimney. It is shown by the fire balloon and by the upward tendency of every flame. It is the prime factor in the propelling power of one of the ancient motors—the windmill; wind being only air rushing forward to take the place of air which is rising because it is rarefied by heat.

The power derived directly from an ascending column of heated air has never been utilized except as a motor for running mechanical toys, and to some extent for operating small mechanical signs.

The toy motor shown in the annexed engraving is too familiar to require description. It is generally placed over a lamp chimney or at the side of a stovepipe, where the rapidly ascending heated air may impinge on the inclined vanes. The air, acting on the vanes according to the well known law of the inclined plane, produces a lateral movement of each vane, and the vanes being restrained at the center of the wheel while free at their outer ends, are compelled to move circularly.

HOT AIR MOTOR.

The aerial top is the reverse of the toy just described. Instead of being made to revolve by a rising column of air, it is made to rise on a column of air by being revolved.

It is of substantially the same form as the hot air motor, but it is made much heavier, in order that it may acquire sufficient momentum to carry it high up in the air. With the application of a sufficient amount of force, this top will rise to a height of 150 to 200 feet. It can hardly be called a flying machine, as it does not carry its own motive power. In the next illustration, however, is shown a flying machine which in one sense carries its own power, that is, stored power.

AERIAL TOP.

It consists of a light frame furnished at one end with a slender rattan bow inclosed in a little bag of tissue paper, which forms a sort of rudder when the fly-fly ascends, and opens like an umbrella when it descends, forming a parachute, which greatly retards the fall. In the crosspiece of the opposite end is journaled a little shaft formed of a wire having on its inner end a loop receiving a number of rubber bands, which are fastened to the opposite end of the frame. To the outer end of the little shaft is secured a piece of cork, in which are inserted two feathers inclined at an angle with the plane of the shaft's rotation, and oppositely arranged with respect to each other.

THE FLY-FLY.

By turning the propeller wheel thus formed, the rubber bands are twisted, and sufficient power is stored in them to turn the propeller wheel in the direction opposite to that required for winding, and thus propel the device through the air.

Another device still more nearly approaching the ideal flying machine is shown in the annexed cut, Fig. 1 being a perspective view of the entire bird and Fig. 2 an enlarged perspective view of the working parts. It is known as Penaud's mechanical bird.

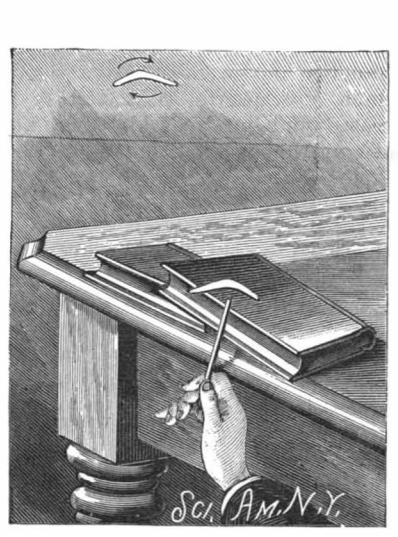
It is a pretty toy, imitating the flight of a bird very well indeed. It soars for a few seconds, and then requires rewinding. Two Y-shaped standards secured to the rod forming the backbone of the apparatus support at their upper ends two wires, upon which are pivoted two wings formed of light silk. The wings are provided with light stays, and are connected at their inner corners with the backbone by threads. In the Y-shaped standards is journaled a wire crank shaft carrying at its forward end a transverse wire forming a sort of balance, and serving also as a key for winding. The inner end of the crank shaft is provided with a loop to which are attached rubber bands which are also secured to a post near the rear end of the apparatus. Two connecting rods placed on the crank are pivotally connected with the shorter arms of the levers of the wings. The rear end of the backbone is provided with a rudder.

MECHANICAL BIRD.

The rubber bands are twisted by turning the shaft by means of the cross wire. When the shaft is released, it is turned by the rubber bands in a reverse direction, causing the crank to oscillate the wings, which beat the air in a natural manner, and propel the device forward. The principle of the inclined plane is involved here, but the plane, instead of being rotated, as in all the cases mentioned above, is reciprocated.

The toy boomerang, which is, in some respects, similar to the regular article, cannot perform all the feats with which the more pretentious implement is credited; but it can be projected, and made to return over nearly the same path.

The toy boomerang is made of a piece of tough cardboard cut on a parabolic curve as shown in the engraving, one arm of the boomerang being a little longer than the other. When laid on an inclined surface, as shown in the engraving, and snapped by a pencil held firmly in one hand and drawn back and released by the fingers of the other hand, the boomerang is set in rapid rotation by the blow, and is at the same time projected, the first part of the trajectory being practically in the continuation of the plane in which the boomerang is started; but when the momentum which carries it forward is exhausted, the boomerang still revolves, and maintains its plane of rotation, so that when it begins to fall, instead of describing the same trajectory as ordinary projectiles, it returns along the same path, or perhaps in a different path, toward the point of starting.



BOOMERANG.

The flatness or curvature of the boomerang and the form of its edges, as well as the position in which it is placed for starting, and the speed and manner of starting, all have an effect in determining the outward as well as the return course of the projectile.

G. M. H.

Treatment of Whooping Cough.

The following method of disinfection of sleeping and dwelling apartments and clothes is recommended by M. Mohn in the treatment of whooping cough. It is said to cure the cases immediately. The children are washed and clothed in clean articles of dress, and removed to another part of the town. The bed room and sitting room or nursery are then hermetically sealed; all the bedding, playthings, and other articles that cannot be washed are exposed freely in the room, in which sulphur is burnt in the proportion of twenty-five grammes to the cubic meter of space. The room remains thus charged with sulphurous acid for five hours, and is then freely ventilated. The children return the same day, and may sleep and play in the disinfected rooms.—*Lancet.*

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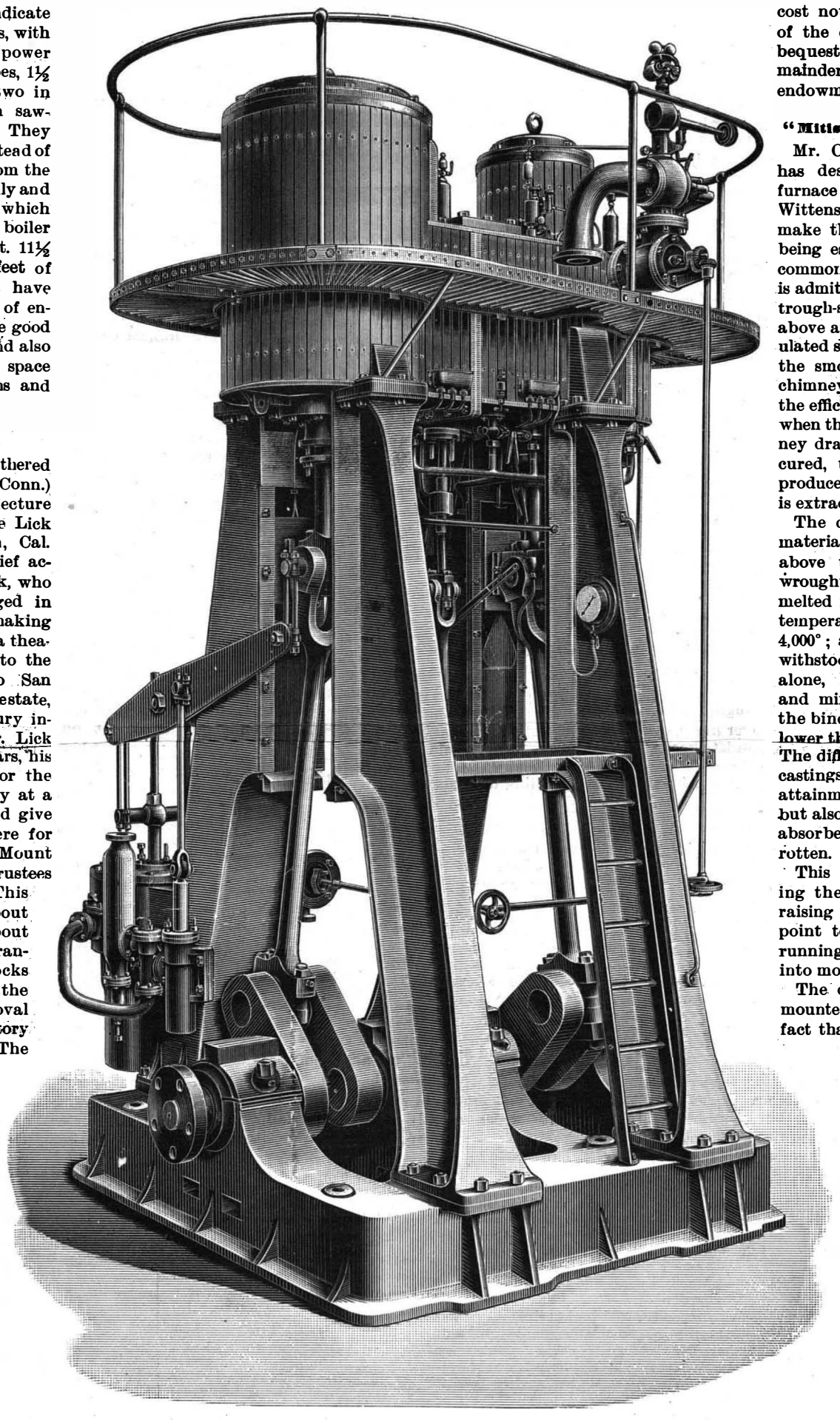
INVERTED CYLINDER MILL ENGINES.

We give a perspective view of a pair of inverted cylinder mill engines constructed by Messrs. Westgarth, English & Co., of Middlesbrough-on-Tees. The cylinders are 15 in. and 30 in. in diameter, with a stroke of 36 in. The high pressure cylinder is fitted with one of Schaeffer & Budenberg's automatic expansion regulating valves. The jet condenser is formed in one of the back columns, and the pump fittings are of gun metal. The crankshaft is 6½ in. in diameter, and is built up.

The engines have been built for the sawmills of Messrs. English Brothers, at Peterborough. They are designed to indicate 250 horse power at 70 revolutions, with a boiler pressure of 90 lb. The power is transmitted by six Manila ropes, 1½ in. in diameter. The boilers (two in number) are designed to burn sawdust and the refuse of the mill. They are of the marine type, but, instead of the flue being carried upward from the smokebox, it is taken downwardly and horizontally below the boiler, which is thus heated externally. Each boiler is 8 ft. 9 in. in diameter by 9 ft. 11½ in. long, and has 540 square feet of heating surface. The makers have been led to advocate this type of engine for land purposes from the good results gained by them at sea, and also from the saving they effect in space and in the cost of foundations and engine house.—*Engineering.*



IMPROVED COMPOUND MILL ENGINE.

The Lick Observatory.

A large audience recently gathered at the rooms of the Bridgeport (Conn.) Scientific Society, to hear the lecture by Prof. David P. Todd on the Lick Observatory at Mt. Hamilton, Cal. He commenced by giving a brief account of the life of James Lick, who in early manhood was engaged in divers occupations, from the making of a piano to the managing of a theater. After acquiring property to the amount of $45,000, he went to San Francisco and invested in real estate, which in a quarter of a century increased one-hundredfold. Mr. Lick died at the age of eighty years, his chief bequest being $700,000 for the erection of a great observatory at a mountain elevation that should give the most favorable atmosphere for astronomical observations. Mount Hamilton was selected by the trustees as being the proper location. This mountain has a summit about 4,500 feet high, and is located about fifty miles southeast of San Francisco. About 45,000 tons of rocks were blasted and removed from the apex, leaving an irregularly oval plateau, upon which an observatory building has been erected. The lands about the mountain, which are set aside for observatory purposes, comprise a government reservation of about 1,500 acres, to which the trustees have added 160 acres by purchase.

As Mr. Lick gave specific direction that the income from his endowment of the observatory should be made useful in promoting science, his trustees made provision for observing the transit of Venus of 1882. The results obtained were found very satisfactory, and Professor Todd showed upon the screen a beautiful picture illustrating clearly the work accomplished. Lantern slides in abundance were used to make plain the lecturer's remarks, although the lecture itself was very comprehensive and unusually clear. Illustrations from different standpoints of all the buildings on the main plateau, the interior of the great observatory, and ground plans of the site and its approach were all highly instructive in connection with the explanations.

The contract for the object glass of the great telescope, which will be the largest and most powerful in the world, was placed with the Messrs. Clark, of Cambridgeport, five years ago. They have just completed the work assigned to them, and the glass has been transferred by palace car to the observatory. The prospective capabilities of the large telescope are exciting astronomers to a state of high tension. They expect to employ a power of 3,500 diameters on the instrument, when the weather is most favorable, and the theoretical distance of the moon would then become about 60 miles. Making due allowance for the unavoidable effects of the earth's atmosphere and other unfavorable conditions, the observer might expect to see the moon much the same as he would without the telescope if it were only a hundred miles away. If at the same time the moon happened to be at its least distance from the observer, about 220,000 miles, and if the objects on the moon were suitably illumined by the sun's light, it is possible that details of its nature might be satisfactorily made out, even although they were no larger than the national Capitol building at Washington.

The location of the observatory in a region which is entirely cloudless during the greater part of the year constitutes an advantage which only those an fully appreciate whose work has suffered serious interruption from the lack of a continuously clear sky. The peak of the mountain stands above the clouds nearly all the time, and a series of pictures were shown, reproducing the startling effect of the sea of clouds.

The means of publication, a most important consideration in the management of a great observatory, has not escaped attention. The legislature of California has shown its entire appreciation of the observatory and its work by the passage of a resolution providing for the issue of such reports, researches, observations, and productions as may come from the institution and be submitted by the Lick trustees for publication. Finally, and most important of all, there is an assured endowment of generous proportions, the income from which is wholly available for the maintenance of the establishment and the prosecution of its work. The considerate management of the trustees will enable them to complete the observatory at a cost not much exceeding three-fifths of the entire allotment of Mr. Lick's bequest for this purpose, and the remainder will constitute the permanent endowment fund of the institution.

"Mitis," or Flexible Iron Castings.

Mr. Ostberg, a Swedish engineer, has described the arrangement of furnace whereby Mr. Noble and Mr. Wittenstroem melt wrought iron and make the so-called mitis castings as being essentially constructed like a common petroleum lamp. Mineral oil is admitted in a stream upon a series of trough-shaped fire bars placed one above another, and the air blast is regulated so as to burn the oil just under the smoking point. The area of the chimney has a great influence upon the efficiency of the arrangement; but when the proper proportions of chimney draught and oil supply are secured, the temperature that can be produced in these petroleum furnaces is extraordinarily high.

The crucibles containing the raw material are placed about one foot above the bars; and 65 lb. of scrap wrought iron—horseshoes, etc.—are melted in from 40 to 50 minutes. The temperature of the molten mass is 4,000°; and this great heat is perfectly withstood by crucibles of good fireclay alone, hard burned, finely ground, and mixed with sugar or molasses as the binding material, which does not lower the fusible point of the whole. The difficulty in making wrought iron castings has hitherto been not only the attainment of the high heats necessary, but also that when fluid the metal has absorbed the furnace gases and become rotten.

This absorption has gone on during the period of superheating or raising the metal from the melting point to that which will permit of running it into ladles and pouring it into moulds.

The difficulty has now been surmounted by taking advantage of the fact that the melting point of alloys is lower than that of the pure metal. Thus, although the melting point of pure wrought iron is 4,000°, if there were only so much carbon in it as would convert it into tool steel, the melting point would be about 1,000° lower, although the carbon is itself infusible. To make mitis castings, therefore, when the pure metal begins to melt, a minute addition of aluminum is made—the actual quantity being only 0·05 or 0·1 of 1 per cent. This addition has the effect of reducing the melting point by 300° or 400°, which is, of course, the same as though the metal were superheated to this amount; the contents of the crucible being reduced from the state of sirup to the fluidity of water. Thus there is no time for the absorption of furnace gases; and the castings as made are, on account of their homogeneity, stronger by from 20 to 25 per cent than the raw material.

THE *Gardener's Monthly* suggests that agricultural colleges assign small plats of ground to such of the students as may desire to cultivate them, and in such way as their tastes or inclinations may lead them. These plats to be supervised or overlooked by some competent person, and reports made at the annual commencement of such as were found to be worthy of special mention.

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ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. Jacob W. Baker and George A. Prescott, of Dover, N. J. This invention consists in a coupling pin having a head of peculiar construction, with special means for lifting or operating the pin, whereby its jamming is avoided, and a straight lift or movement obtained for it under all circumstances.

A car coupling has been patented by Mr. Frank Betts, of Irwin, Col. At the inner end of the drawhead opening are securing plates, arranged in such manner that they may be moved in a plane at right angles to the length of the drawhead, these plates being actuated inward by springs, together with a special design of coupling bar, and other novel features.

Locomotive valve gear forms the subject of a patent issued to Mr. Wallace J. Lewis, of Tyler, Texas. The invention consists of a centrally pivoted lever, operated from the cab of the locomotive, with slotted reversing arms actuated by the lever, and connected to the valve rod, the invention being an improvement on a former patented invention of the same inventor.

A traction engine has been patented by Mr. William L. Leland, of Oroville, Cal. Separate engines are mounted upon the truck frame for the front and back wheels, the engines being only connected to the boiler by flexible pipes, and there being combined with the truck frames a central steering gear, whereby both truck frames are equally and simultaneously turned.

A traction engine has been patented by Mr. William A. Shadd, of North Buxton, Ont., Canada. This invention relates more particularly to an apparatus for guiding the engine, providing an effective, easily handled steering gear, which, when adjusted by hand levers, will be operated by the power of the engine itself, the engine being adapted for plowing, thrashing, hauling ditching machines, etc., and being so constructed that it can be turned within its own length.

A railway operating plan has been patented by Mr. Alexandre F. Godefroy, of St. Louis, Mo. Its design relates partly to transit, partly to the cars, and partly to the track, it being intended that a moving train can, without stopping, drop its rear passenger car so the latter will come to a stop at the station, after running up a slight incline, and that a car can be added to the moving train with the momentum it would acquire in running down a similar incline.

MECHANICAL INVENTION.

A saw swaging machine has been patented by Mr. William G. Baumgardner, of Filer City, Mich. It has a sliding swage gate carrying a stationary anvil die, with an oscillating die operated from the main shaft, an automatic clamp lever, an adjustable saw blade holder, and a device for moving the saw, making a machine which is automatic in operation and adjustable to saws of any shape or size.

AGRICULTURAL INVENTIONS.

A combined planter and cultivator has been patented by Mr. Aaron L. Parker, of Philadelphia, Miss. This invention covers a novel construction and combination of parts in a planter and cultivator designed to be readily adjusted for use in either capacity, and one adapted to do a large variety of work.

A listing plow has been patented by Mr. Joseph S. Crum, of Manhattan, Kan. The plowshare has the forward portion of its cutting edge reduced and horizontal, with an upwardly inclined and outwardly extending rear portion, whereby provision is made for cultivating both the bottom and sides of the furrow.

A wheel cultivator has been patented by Mr. Stephen A. D. Thomas, of Perrysville, Ind. It has a sectional axle, with an externally screw-threaded sleeve upon each section, and a screw-threaded yoke on each sleeve carrying the cultivator frames, with provision for adjusting the cultivators independently of each other, with various other novel features of construction and arrangement of parts.

MISCELLANEOUS INVENTIONS.

A machine for cutting cigar wrappers has been patented by Mr. James W. Cameron, of New York city. It is so constructed that with it one leaf, or fifty to a hundred leaves, called a book, may be cut at one operation, without the aid of any sustaining devices for holding the leaves in place while being cut.

A mop wringer has been patented by Mr. John Harris, of Lansingburg, N. Y. It consists of a roller frame held to a vessel to hold the water wrung from the mop, the rollers held in the frame exerting a squeezing pressure on the mop fabric to a degree which is governed by the pressure of the foot upon a treadle.

A cocoanut grater has been patented by Mr. Oscar Domalski, of Brooklyn, N. Y. This invention relates to improvements in vegetable graters having a rotary disk, with a perforated grating surface, and mounted to rotate horizontally, a hopper being placed above the disk, a plunger sliding in the hopper, and means for rotating the disk.

A hay stacker has been patented by Mr. Clark W. Huntley, of Chariton, Ia. In combination with a frame having inclined beams is a fork attached to arms having friction rollers, arms with a cross piece pivoted to the fork arms and the main frame, a balancing box with pulleys, ropes, sheaves, etc., whereby hay is readily elevated and discharged upon the stack.

A plaiting board has been patented by Mr. John P. Caldwell, of Gainesville, Ga. It is a combined plaiter and lap board, designed to enable the operator to rapidly lay off regular plaits of any desired depth, which may be either pressed or stitched to place after being formed, spaces between the plaits being measured by graduations on the sides of the board.

A furnace for fruit driers and other uses has been patented by Mr. Hugh S. Jory, of Salem, Oregon. It consists of an inclosing casing, across which extends a furnace, with a smoke flue projecting from the top up through the casing, and diametrically opposite draught openings with dampers, to thoroughly consume the fuel and utilize the heat.

A horse power has been patented by Mr. Ira A. Jefferson, of Salt Lake City, Utah Ter. It is a machine especially adapted for use at mines, being very compact and the parts detachably united for convenience in transportation, the construction being such that the machine can be very easily operated and hoisting may be speedily accomplished thereby.

A paper box has been patented by Mr. Joseph T. Craw, of Jersey City, N. J. It is a box which when set up will have a flat, springless bottom, without exposed folds, the blank from which it is made being so cut and scored that when the parts are adjusted they will be locked against displacement, without the aid of paste, except upon the main paste flap.

A rein holder has been patented by Mr. Romeo P. Tomassek, of New York city. The invention consists in a pair of clamping jaws, one for each rein, which are closed by a spring, and are arranged to be opened by the pressure of the foot, making a simple and efficient rein holder for attachment to the dash board.

An extension table has been patented by Mr. Frederick W. Nye, of Columbus, O. It has slide bars with recesses in their adjacent faces, and spring-pressed pins for pressing the bars apart and limiting their movement, with metal slides, and other novel features, making a simple, strong, and durable table, which can be cheaply manufactured.

An adjustable draughting table has been patented by Mr. John G. Aston, of Asheville, N. C. It is so made that, by means of a rockered supporting frame, the angle of the board can be adjusted at will with reference to its base, while, by loosening a binding screw, the board may be turned on the frame to suit the convenience of the draughtsman.

A supply and drain pipe connection for washstands has been patented by Mr. William D. Schuyler, of New York city. It is a direct supply faucet connection with the drain pipe valve, by combining a faucet having an axially turning or rotating barrel with the valve, through the intervention of a flexible or loose connection, all complicated mechanism being avoided.

A kitchen cabinet has been patented by Annie E. Irwin, of Memphis, Tenn. It is made in three divisions, each containing compartments, the divisions having suitable hinged and bolted doors, the door of the central division forming a bread or biscuit board when opened, while a mirror is on the top of the case, the design of the whole being ornamental as well as useful.

A brush extractor for pulling up brush or clumps of bushes by animal power has been patented by Mr. Samuel Maxim, of Wayne, Me. It consists of a pair of forceps jaws with suitable handles, with a chain attached to one of the jaws near the point, and extending through an eye projecting from the opposite jaw, for partly encircling the bushes and binding them tightly in the points of the forceps.

A spring motor has been patented by Messrs. Emanuel Nichols, of Unadilla, and Daniel W. Clark, of Grass Lake, Mich. This invention consists more particularly of a peculiar arrangement for accelerating and regulating the reciprocations of the rock shaft through which the power is applied, together with a novel spring winding attachment, and various other special details of construction.

A door or window fastener and alarm has been patented by Mr. John L. Painter, of Bellevue, O. This invention consists in a slotted triangular frame having a convex side, a claw with a pivot extending through the slot of the frame, the claw being adapted for insertion in the door jamb, and a spring-actuated hammer for exploding a percussion cap for giving an alarm.

An end gate for wagons has been patented by Mr. Henry C. Higgins, of Winona, Minn. It is formed in two sections, made so that they meet at about the transverse center of the wagon, and united by a pivotally connected lever and links, so that grain, potatoes, and other similar articles, carried in bulk, may be unloaded from the wagon without the necessity of taking out the tie rod.

A tobacco scrap breaker has been patented by Mr. Samuel P. Collins, of Allegheny, Pa. It consists of a toothed cylinder, a yielding toothed bar journaled next to the cylinder, a perforated apron under the cylinder and bar, and a reciprocating screen below the apron, with other novel features, the machine being also adapted for other uses, such as a grain thrasher and cleaner, and for similar work.

A tug coupling has been patented by Messrs. Elisha A. Rouse and Henry Summers, of Bozeman, Montana Ter. In connection with a fixed jaw, with an end stud having a pin, is a pivoted jaw with an aperture or hole to receive the pin, a number of back end shoulders, and a spring-pressed latch adapted to engage the shoulders, making a simple and secure coupling, easily connected with an eye or ring.

A heel for boots or shoes has been patented by Messrs. Paul Stucker and Christian Neu, of Brooklyn, N. Y. This invention relates to detachable heels, and consists principally of screw connections of the sole and heel, one permanently and the other adapted to be revolved by a key, whereby the heel may be quickly and easily detached from and attached to the boot or shoe, and can be firmly held in place.

A wagon box lock has been patented by Messrs. Joseph Marx and Joseph H. Mueller, of Cross Plains, Wis. It consists of two T-headed rods pivoted to the ends of the shorter arm of a T-lever, and a pawl connected with the longer arm of this lever, adapted to engage notches in one of the T-headed rods, in such manner as to make a simple and efficient fastening for the end gates of wagon boxes.

A laying out machine has been patented by Mr. Edward A. Jerome, of East Portland, Oregon. It is designed to lay out material to use in making sash, doors, blinds, etc., marking it to indicate the face side and work edge, so the operator will know how to run the material through the machine, and the invention consists of various novel details of construction and arrangement of parts.

A regulator for flues has been patented by Mr. James Cant, of Orebridge, Thornton, Fifeshire, Scotland. It is especially designed for the more perfect regulation of the ventilating of sulphuric acid chambers, or other chambers and furnaces, fires, and close places, or of flues and ducts leading from such places, the invention consisting of various novel details in the construction and arrangement of parts.

A stanchion has been patented by Mr. William H. Youngs, of Waverly, Iowa. It has a lower supporting step, a bracket formed with a longitudinal slot, and a spring connected to the stanchion and to a fixed support in advance of it, whereby cattle may be secured in their stalls and have a wider and freer range of movement than was possible with the old style of device.

A basket cover has been patented by Mr. Hiram Gary, of Croton, N. J. It is of such fabric as ordinarily used in connection with fruit baskets, and is provided with a metallic spring secured at one end within the margin of the cover, the free end overlapping the fixed end, making a fruit basket cover which can be easily removed to display the fruit, and can be readily sprung back over the basket.

A bale tie has been patented by Mr. William P. Rylander, of Lockhart, Texas. This invention consists principally of a bale tie jaw stamped from sheet metal, formed with an open hook at one end in front of a curved edge, with an opening at the other for attachment to the bale hoop, the opening being shaped to permit the jaw to have a pivotal side motion upon the hoop.

A centrifugal dish washer has been patented by Mr. Allen G. Ingalls, of Granby, Quebec, Canada. It consists of a dish water tank, a rotary rinsing water bucket with transverse partitions and discharge pipes, a basket to receive the dishes, pumps to discharge water over them, lamp-heated flues, and an operating mechanism, so that dishes can be thoroughly washed, rinsed, and dried by the machine.

A knitting machine has been patented by Mr. Isaac W. Lamb, of Jackson, Mich. The object of this invention is to improve the Lamb knitting machines formerly patented in details of construction to enable the machine to do a greater variety of work, to be run faster, and to be more easily adjusted for different kinds of work, and at the same time to render its construction more methodical, cheaper, and more durable.

A fruit picker has been patented by Mr. William S. Mallard, of Darien, Ga. Combined with a handle, and a ring fixed on its upper end, is a fruit-conveying tube attached to the ring, and a spring connected with the tube for holding a portion of it normally slack, with other novel features, making a device for severing the fruit from its stem or branch, and a bag for receiving the fruit when severed.

A lead pipe reel has been patented by Mr. Fred. Eitapenc, of Binghamton, N. Y. It consists of an outer rolling circular case, within which the reel proper is arranged, having the same axial center, the reel consisting of opposite heads mounted on flanged metal sockets, its shaft carrying bars, between which an end of the pipe is entered before coiling, the shaft being operated by a crank, the construction being simple, strong, and efficient.

An attachment for stoves has been patented by Mr. James A. Porter, of Jackson, Mich. It consists of a hollow, semi-cylindrical drum supported above the stove, concaved upon its inner side, and having a series of apertures, with funnel-shaped conductors having telescopic tubes to cover the top openings of a stove and conduct the gases or smoke to the drum, to prevent these, or odors from the cooking, affecting the air of a room.

An alarm for hoisting machinery has been patented by Mr. Robert Mulholland, of Mineville, N. Y. A rock shaft is connected with an alarm bell, and is provided with a weight to be engaged by the hoisting rope when a given amount of the rope has been wound upon the drum of the hoisting engine, with means for adjusting the apparatus to give an alarm when any prescribed amount of rope has been wound upon the drum.

A centrifugal amalgamator has been patented by Mr. William White, of Mount Vernon, N. Y. It is so constructed that crushed ore or sand containing precious metals may be fed to a revoluble pan containing mercury, and caused to pass to and fro across the surface of the pan as it travels toward the periphery under the effect of the rapid rotation of the pan, the amalgamator being applicable for either wet or dry crushed ore or metal containing sand.

A process of naphthol dyeing, a product thereof, and the application of such process to dyeing textile animal fibers or vegetable fibers, form the subject of three patents issued to Mr. Thomas Holliday, of Huddersfield, York, England. The process consists in forming on the fibers a deposit of oxide of lead, or a lead soap, and combining therewith alpha or beta naphthol to form azo coloring matter, by treating the cotton, etc., with a solution of oxide of lead in caustic alkali, and when a soap is required passing the goods through a solution of it, or an oily emulsion, and then treating the goods with naphthol in solution, the lighter or darker shades being produced by the use of varying quantities of the matters used in relation to each other, the process being varied for application with textile animal fibers, or with cotton or other vegetable fiber, in a raw state, or spun, woven, or otherwise manufactured.

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The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Curtis Pressure Regulator and Steam Trap. See p. 142.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) G. W. J. writes: I wish to build a steamboat 50 feet keel, 15⅝ feet beam, 55 feet on deck. What power engine, and what diameter screw wheel, will it require to drive her 10 or 12 knots per hour? The water in which she will be placed—Great Salt Lake, Utah, has a buoyancy one-fourth greater than that of ocean water. Her draught will be very shallow. Salt from condenser to be utilized. A. A stern wheel is better adapted to shallow draught boats of wide beam. For a boat of your description, a screw wheel should be at least 3 feet in diameter to be efficient. An engine with cylinder 8 x 8, working up to 15 horse power, will probably suit your requirements. Keel condensers are mostly used for small boats and yachts. See descriptive illustrations of small steamers in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 108, 425, 398, 217, 179, 224, 172.

(2) C. B. P. asks how to solder sheet brass, with ordinary copper soldering iron, and what kind of flux to use. A. For soldering with a copper, use a solder made of 2 parts tin, 1 part lead, by weight; melt, mix, and pour in small bars. For flux dissolve zinc in muriatic acid until no more will dissolve, add about one-tenth its bulk of sal ammoniac, and dilute with one-quarter its bulk of water. Wet the surfaces to be soldered with this solution, using a piece of wood or copper wire for this purpose. Then, by rubbing the surfaces with the tinned point of the copper, a coating of tin will be imparted. Put both surfaces thus prepared together, and heat by applying the copper and a little solder to the outside of the seam. The copper should be well tinned on the point, which may be done by heating the copper hot enough to freely melt pure tin. Rub a piece of sal ammoniac on a brick, then rub the copper point on the brick, with tin or solder in contact with the point. The tinning of the copper point is essential for soldering.

(3) J. W. B. asks: What combustible can be manufactured and applied in a series of small drops to a belt, so it will ignite by scratching with small instrument? A. Either of the following: 1st. One-half part by weight red phosphorus, 4 chlorate of potash, 2 glue, 1 whiting, 4 finely powdered glass, 11 water. 2d. 2 parts by weight red phosphorus, 5 chlorate of potash, 3 glue, 1½ red lead, 12 water. The manipulation of these mixtures is very dangerous.

(4) T. P. P. asks how blackboard slating is made. A. Use ½ gallon shellac varnish, 5 ounces lampblack, 3 ounces powdered iron ore or emery; if too thick, thin with alcohol. Give three coats of the composition, allowing each to dry before putting on the next; the first may be of shellac and lampblack alone.

(5) S. K. desires a receipt for mending broken marble. A. Take plaster of Paris, and soak it in a saturated solution of alum, then bake it in an oven, the same as gypsum is baked to make it plaster of Paris; after which grind the mixture to powder. It is then used as wanted, being mixed up with water like plaster and applied. It sets into a very hard composition, capable of taking a very high polish, and may be mixed with various coloring minerals to produce a cement of any color capable of imitating marble.

(6) A. A. B. desires a formula for making an ink that will conduct electricity, such as is used in telegraphy, for producing at the other end of a line a facsimile of a drawing, etc. A. A silvered or bronzed paper is used, which will conduct electricity. A non-conducting ink is used on this, not a conducting ink. Any heavy carbon ink will answer.

(7) O. S. C. asks a recipe for making a blue stencil paint which will not rub off when used on wood boxes. A. Take of shellac and borax each 2 ounces, boil in water until they are dissolved, then add 2 ounces gum arabic and withdraw from the fire. When the solution has become cold, add enough more water to make 25 ounces, and finish by mixing with Prussian blue sufficient to bring it to a suitable consistency and color.

(8) M. R.—For a French polish, dissolve 12 ounces shellac in 1 quart wood naphtha, add ½ pint boiled linseed oil, thoroughly mix, and rub the furniture with a small quantity on a woolen cloth.

(9) W. H. J.—See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 472 and 429, for directions for making enamel photographs.

(10) B. J. D. asks: 1. Will you please inform me of the best means to separate wire nails from the sawdust in which they are tumbled. I use hand sieves, and find it tedious, and it consumes too much time. A. Your question can hardly be considered of general interest. For separating the nails from the sawdust, we recommend a revolving tumbler set at an inclination, with the upper end solid, lower end a sieve of the proper mesh. Feed the nails and sawdust from a hopper spout at the upper end, constantly. The sawdust will work through the sieve, and the nails be discharged from the lower end clean and dry. 2. Also the next best lubricant to oils, in running the wire into the machines, as it requires so much tumbling and sawdust to clean the oil from them, and make them bright for use? A. For a lubricant use strong soap water; pass the nails through boiling water on a wire cloth apron and over a steam coil or other hot surface, and leave out the tumbling and sawdust.

(11) J. L. H. asks: 1. Is there any cement for glassware which will stand hot water? A. Glue to which bichromate of potash has been added, and which has afterward been exposed to strong sunlight, becomes insoluble. The proportions are not very well ascertained, but about 1 part of the bichromate, dissolved in water, and added to a solution of 6 parts of solid glue, answers very well. 2. Is there anything which will take mildew out of white goods which have been washed? A. Wet the spots with a very weak solution of chloride of soda (Labarraque's solution) or of chloride of lime (bleaching fluid) or with chlorine water and wash afterward.

(12) H. J. desires the formula used by envelope manufacturers in mixing their gum. A. Gum arabic and water mixed to proper consistence.

(13) A. B. C. asks how to make some preparation for forcing the beard or hair on bald spots to grow. A. Take of cologne 2 ounces, liquid hartshorn 1 drachm, tincture of cantharides 2 drachms, oil rosemary 12 drops, lavender 12 drops. Apply daily for a considerable period of time, it being sometimes necessary to continue the application through several weeks. This will help stimulate a growth if there are any live hair roots. If such roots be dead, or there are none, there is no preparation which will make the hair grow.

(14) J. B. desires process of giving wax that has turned yellow a clear color. The only satisfactory method of bleaching wax is by exposing it to the sunlight in thin sheets. The use of chemicals is impracticable in your case, and we fear you will find it impossible to restore the doll's faces to their original tints.

(15) G. E. M. asks best way for transferring engravings, prints, photos, etc., to glass for magic lantern slides. A. You cannot produce a satisfactory slide by varnishing a plate and squeegeeing the picture on to same, then removing the surplus paper on the back. It will not clear enough. The quickest and best way is to copy the picture in a cheap camera on glass, producing a negative the right size, by the ordinary dry plate photo process. Then from the negative so obtained, by contact in a printing frame on a special lantern slide dry plate, make the positive lantern slide. Dealers in photo materials will supply the things necessary.

(16) M. F. B. asks: 1. Is the time telegraph from Washington the mean time of the 75th meridian from Greenwich, or the mean time of the meridian of the Washington Observatory? A. Time for railroads and most civil purposes is telegraphed from Washington to various stations, as New York, Cambridge, and Alleghany, and is the time for the 75th meridian from Greenwich. At these stations, time clocks are running in unison, and from them time is distributed to various points by the Western Union Telegraph. The time balls are dropped at New York, Philadelphia, Baltimore, Washington, Hampton Roads, Savannah, and New Orleans, by telegraph from the National Observatory. 2. Has the decision or recommendation of the late "Congress on the establishment of a first meridian," to begin the astronomical day with the civil day, been adopted by observatories and ephemerides generally? A. The recommendation in regard to the civil and astronomical unit has not been adopted by astronomers. It meets with some opposition, as its adoption makes a break in the continuity of record.

(17) J. F. writes: 1. If I lay down 600 feet of one inch pipe in my rooms, and fire from a coil, what will the amount of expansion of the water be? A. The expansion of water from 46° to 212° is 0·0466 of its volume. The iron pipe also expands, due to the temperature of the water. The expansion of the water in the 600 feet of inch pipe will be about 135 cubic inches. 2. What can I add to the water to keep it from freezing, in case the fire goes out? A. Add one or two pounds chloride of magnesium to the water in the coils to prevent freezing.

(18) W. H. D.—You may obtain the plain lenses for a 3 foot telescope, as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 252, at from $6 to $8. If the object glass is achromatic, it will cost about $15.

(19) W. H. C. asks: 1. Can water be said to belong to the mineral kingdom? A. It is treated as a mineral by authorities on the subject when occurring in the earth. It forms the larger proportion of the human body, and then cannot be so considered. It may be termed of intermediate nature. 2. Can the reflections of a red dress in a mirror be called red? A. Reflection is only changing the direction of a ray of light or color, and has nothing to do with its make-up. The pictures seen in a glass are spoken of as of the colors they reflect.

(20) J. F. asks process for printing from dry plates. A See SUPPLEMENT, No. 483, page 7707, for blue prints, and SCIENTIFIC AMERICAN, August 2, 1884, page 65, for silver printing, in photographic items.

(21) F. S. H. asks: 1. In an inch and a quarter cable, such as used in cable railways, gripped in jaws 24 inches long, raising the cable 8 inches above its sheaves, in what distance each way from the grip will the cable fall to the sheaves again, supposing it to be on a tangent? A. This depends upon the distance between the sheaves. 2. What is the cost per single track per mile of a first class cable conduit for street railway? A. $40,000 to $75,000. 3. Supposing it practicable to operate street railways by electricity, in what would be the probable advantage in cost of operation over a well arranged cable system? A. Electric railways are not yet sufficiently established to warrant an opinion.

(22) S. G. S.—There is nothing but a scraper good for taking off old, scaly whitewash. Bronzing liquid may be a paint made with light colored varnish in which is mixed gold bronze. The varnish may be shellac, mastic, or light furniture varnish thinned with turpentine.

(23) J. S. asks: How many feet of heating surface is calculated per horse power on a boiler at 60 pounds pressure? A. 150 square feet.

(24) J. S. P.—The influence of the sun and moon in making tidal waves of the atmosphere is no doubt true to a small extent, and was discussed by meteorologists in the early years of the century. We do not know who first suggested it. The tidal action is so complicated with and overshadowed by heat and local wave fluctuations that it is not taken into account by the meteorologists of the present day. There are mooted points now being discussed in astronomical circles that may ultimately rectify some observed irregularities in planetary motion.

(25) E. M. H. asks how to make tin plate look like brass. A. A yellow varnish can be brushed on, or, as in fancy cans, the color is printed on with a thick yellow varnish. The operation is of a similar nature to japanning.

(26) Q. A. L. asks how organ pipes are made, what solder is used, and how the soldering is done. A. Organ pipes are made of equal parts by weight of tin and lead, which melts at 370°, rolled in sheets. The solder is made of 1½ parts tin, 1 part lead by weight, which melts at 334°. Solder with a copper and resin. Some care must be used and a little practice to accomplish the soldering smoothly, so as not to melt the pipe. If the solder should be found not tractable enough for your experiment, add half a part of bismuth to the solder as above.

(27) John H. asks: 1. How far is the sun from the earth? A. The distance from the sun to the earth is between 92,500,000 and 98,000,000 miles. 2. What is the circumference of the earth? A. The mean circumference of the earth is 24,898 miles. 3. What of the sun? A. The diameter of the sun is 860,000 miles; its circumference about 2,700,000 miles. 4. Also diameter of earth? A. The polar diameter of the earth is 7,898 miles; equatorial, 7,926 miles; mean diameter, 7,916 miles.

(28) D. S. S. asks: Would you inform us in settlement of an argument as to the best method of gas saving—by closing cocks near the burner or by regulating at the meter? A. In general terms, the further from the burner the regulating is done the better. Gas should be as unobstructed as possible in its path to the point of consumption, so as to avoid eddies, which impair the illuminating power. The only objection to governing or regulating at the meter is, that it does not allow for different elevations of burners, and it does not, when cock regulating is used, allow for the burning of varying numbers of lights. The use of large burners and fewer in number is to be advocated.

(29) J. I. asks: Is it heavier on a horse to pull a load by a 100 foot rope or chain than close to it? A. If the rope or chain is free from friction on the ground, it is easier for a horse to pull a given steady load by the long hitch. Much depends upon the condition or kind of work.

(30) E. E.—The dividing engines of the surveying instrument makers will divide circles for any number of spaces. The gear cutting index has a small range only applicable to gearing. For description and illustration of gear cutting apparatus, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 50, 317.

(31) W. B. M.—For computing the horse power of a rotary engine, multiply the area of the blades or driving surfaces (as many as receive the pressure of the steam) by the mean engine pressure, and this product by the speed of the centers of area of the blades in feet per minute. Divide the last product by 33,000 for the horse power. For illustrated descriptions of rotary engines see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 11, 267, 397, 19, 149. The history of rotary engines certainly points to "dynamical misconception," or some other grave fault in the construction of most of them.

MINERALS, ETC.—Specimens have been received from the following correspondents, and have been examined, with the results stated.

W. M. H.—The metallic-looking mineral is pyrite, or sulphide of iron. The cube is hematite, or oxide of iron (a pseudomorph after pyrite possibly).

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

January 11, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid and substitutes thereof, manufacture of salicylic, T. Kempf ... 355,875
Alarm for hoisting machinery, R. Mulholland ... 355,888
Amalgamator, centrifugal, W. White ... 355,958
Animal trap, N. C. Boynton ... 355,857
Annunciator, electric, P. Seiler ... 355,791
Automatic clasp to hang up trousers, etc., W. Peterson ... 355,711
Ax, W. J. & J. A. Dunning ... 356,060
Axles, repairing wagon, J. H. & A. T. Currie ... 356,081
Bale tie, W. P. Rylander ... 355,887
Banjo, S. S. Stewart ... 355,896
Barber's chair, J. M. Baker ... 355,854
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Wine, Tokay, California Vintage Company..... 13,963
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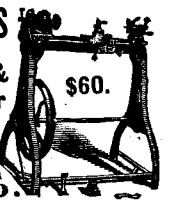

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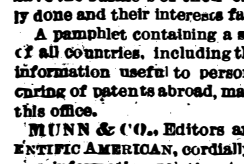

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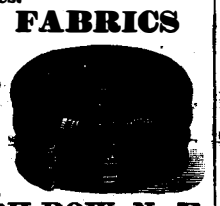

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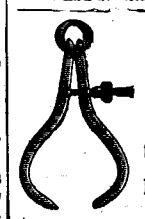

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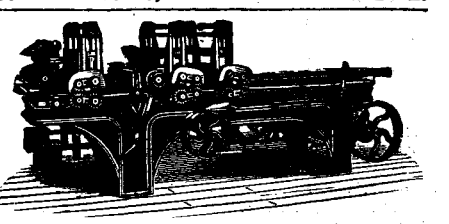

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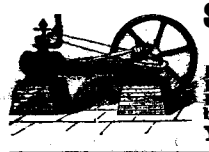

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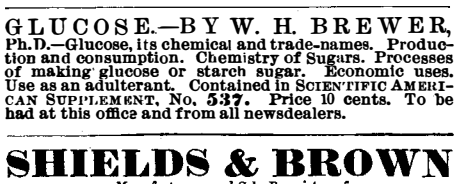

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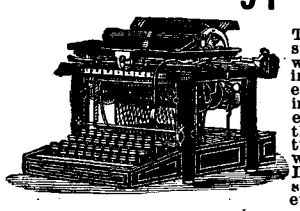

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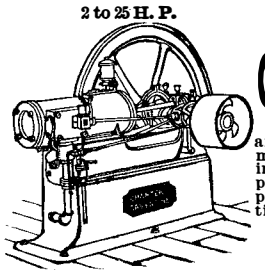

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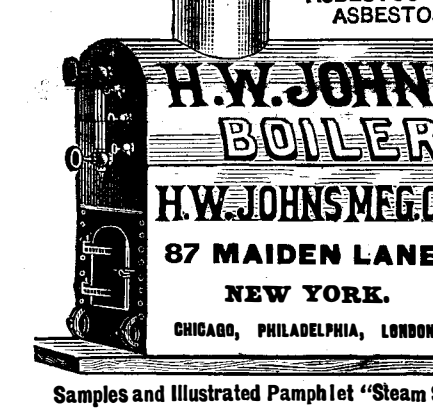

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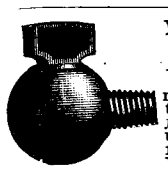

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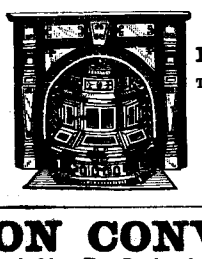

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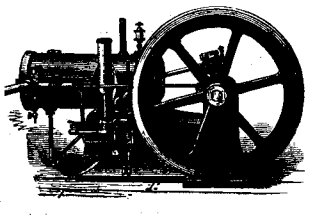

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